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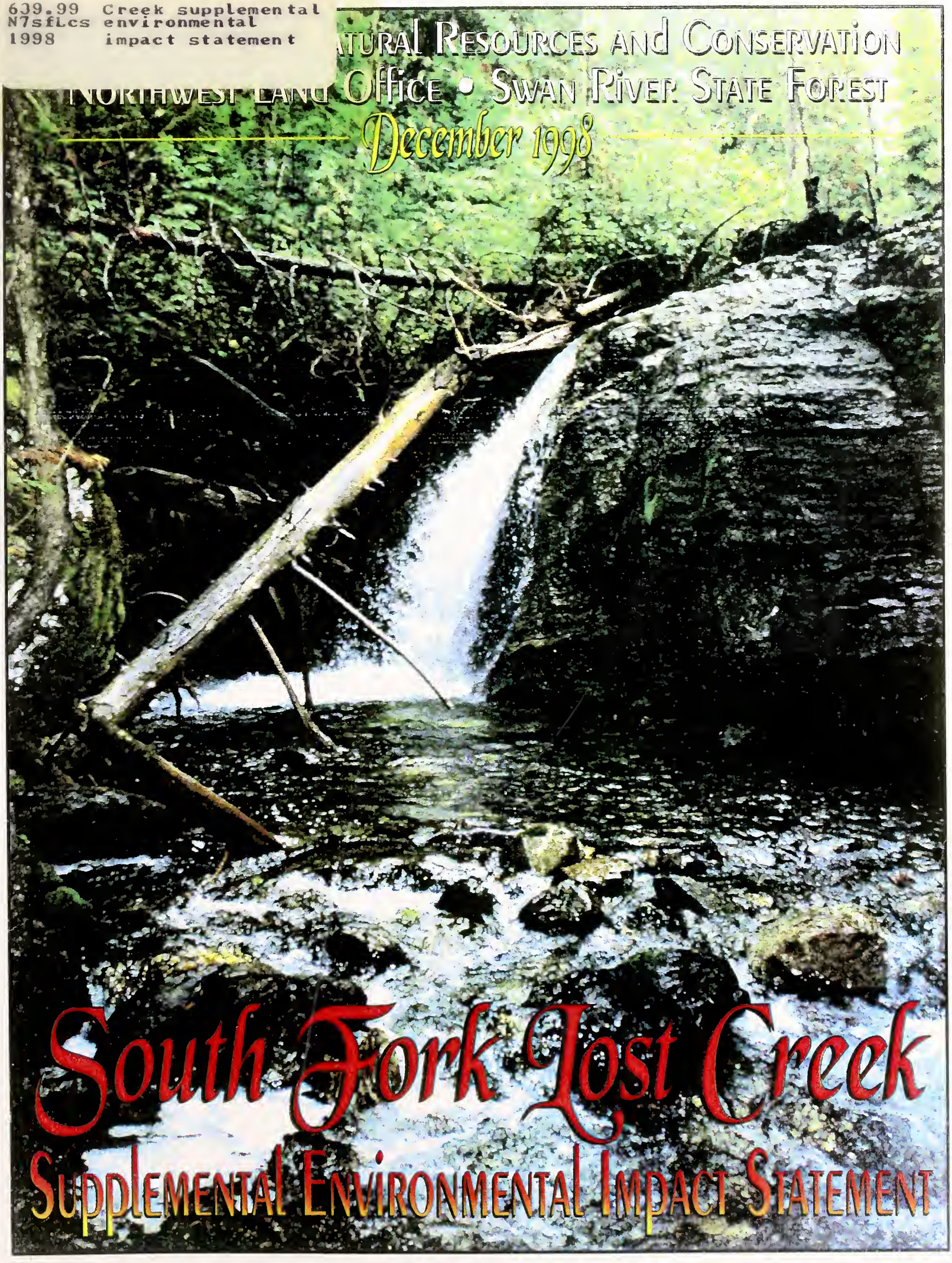
December 1998



South Fork Lost Creek

Supplemental Environmental Impact Statement

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December 29, 1998

SOUTH FORK LOST CREEK
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

Enclosed you will find a copy of the South Fork Lost Creek Supplemental Environmental Impact Statement (SEIS). The need to produce a SEIS was prompted by additional concerns raised by the public, Land Board staff and Department of Natural Resources and Conservation (DNRC) personnel after the South Fork Lost Creek Final Environmental Impact Statement was published. You are encouraged to review the SEIS and provide comments to the Swan River State Forest, 58741 HWY 83, Swan Lake, Montana 59911. Comments must be received by January 30, 1999. Your comments will be addressed in a return letter and placed in the South Lost Creek project file.

The South Lost Creek SEIS considers five alternatives. Alternative D is identified as the preferred alternative in the SEIS.

Thank you for your time and comments.

Sincerely,

Glen Gray
Unit Manager
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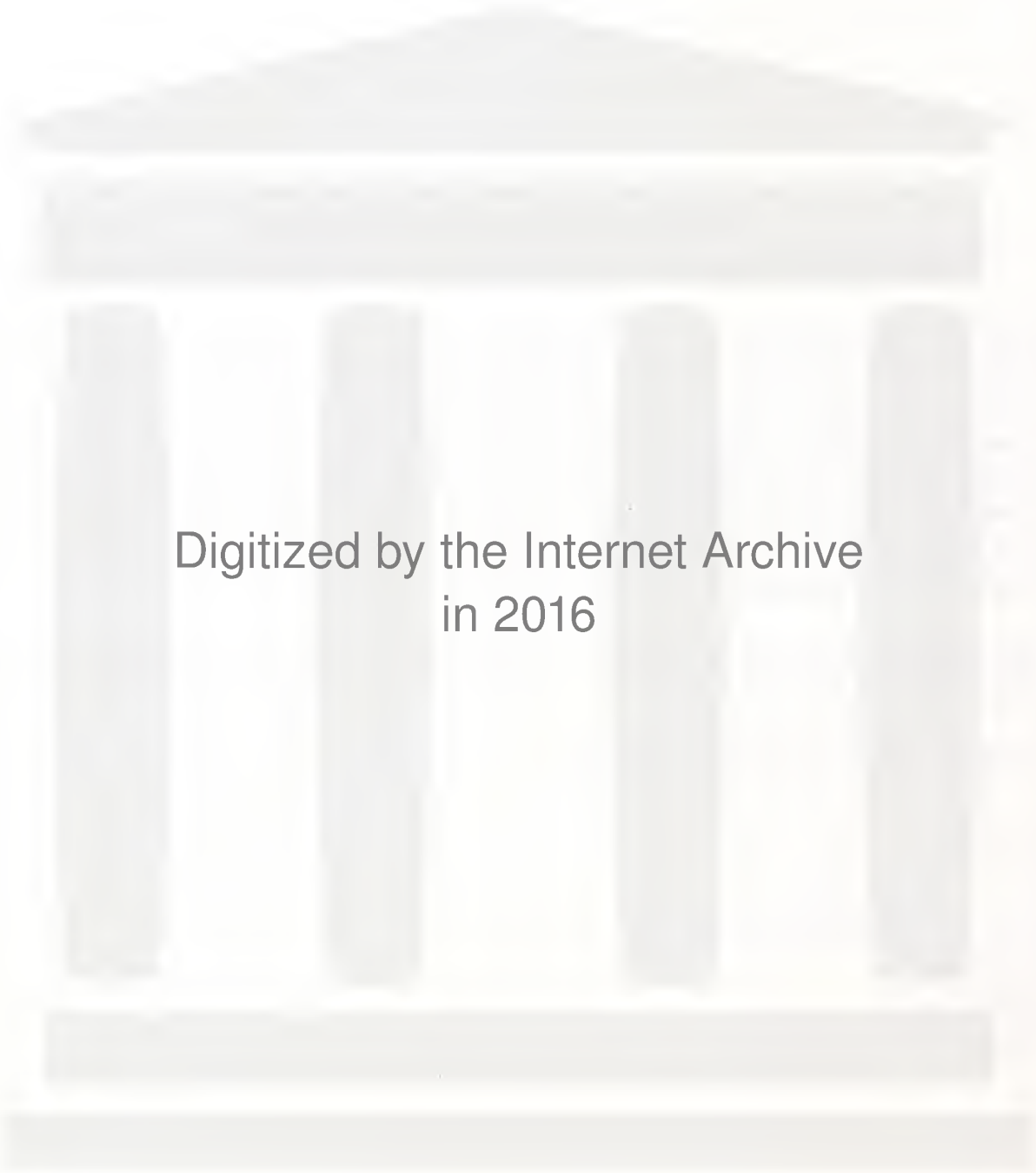

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ABBREVIATIONS

BMP	Best Management Practices
BMU	Bear Management Unit
CEA	cumulative effects assessment
DBH	diameter at breast height
DEQ	Montana Department of Environmental Quality
DFWP	Montana Department of Fish, Wildlife and Parks
DNRC	Montana Department of Natural Resources and Conservation
ECA	Equivalent Clearcut Acres
EIS	environmental impact statement
ESA	Endangered Species Act
FI	Forest Improvement
FNF	Flathead National Forest
FRTA	National Forest Roads and Trails Act
FY	fiscal year
GIS	Geographic Information System
H.E.	habitat effectiveness
HTG	habitat type groups
ICRB	Interior Columbia River Basin Project
ID Team	interdisciplinary team
IGBC	Ineragency Grizzly Bear Committee
MBF	thousand board feet
MEPA	Montana Environmental Policy Act
MFI	mean fire interval
MMBF	million board feet
NCDE	Northern Continental Divide Ecosystem (Grizzly Bear Recovery Area)
ORD	open road density
OSHA	Office of Safety and Health Administration
RMS	Resource Management Standard
ROD	Record of Decision
SFLMP	State Forest Land Management Plan
SLI	Stand Level Inventory
SMZ	streamside management zone
SRSF	Swan River State Forest
SSFI	sale specific forest improvement
SVGBCA	Swan Valley Grizzly Bear Conservation Agreement
TAS	timber accounting system
TRD	total road density
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

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SUMMARY

Supplemental Environmental Impact Statement for the South Fork Lost Creek Proposed Timber Sale

PROPOSED ACTION

Swan River State Forest (SRSF) proposes to harvest timber in the South Fork of Lost Creek drainage. SRSF is a branch of the Montana Department of Natural Resources (DNRC). The project area is located approximately 4 miles southeast of Swan Lake, Montana, and includes three full sections and portions of eight others in T24N-R17W, for a total of approximately 4,161 acres. If a harvest alternative is selected, 254 to 607 acres would be harvested through various silvicultural treatments. The SRSF Stand Level Inventory was screened to identify stands classified at risk and recommended for harvest

PURPOSE

The proposed harvest, ranging from about 3.5 to 11 MMBF of timber, is intended to improve the health of the forest and generate funding for the Montana School Trust Fund. The land involved in this proposed project is held by the State of Montana in trust for the support of public schools (Enabling Act of February 22, 1889; 1972 Montana Constitution, Article X, Section 11). DNRC and the State Board of Land Commissioners (Land Board) are required by law to administer these trust lands to produce the largest reasonable and legitimate return over the long run (Section 77-1-202, MCA).

THE AFFECTED ENVIRONMENT

The South Fork Lost Creek project area is located in the northeast corner of the Swan River State Forest approximately 4 miles southeast of Swan Lake. The 4,161 acres in the project area range in elevation from 3,360 feet where the South Fork of Lost Creek leaves the project area to 7,238 feet at the crest of an unnamed peak on the southeastern boundary. The project area consists of a steep, narrow, uninhabited canyon with rocky cliffs, limited access, avalanche chutes, heavy-timbered slopes, subalpine terrain and riparian areas along the South Fork of Lost Creek and small feeder streams.

Game animals inhabiting the project area, at least part of the year, include mule and white-tailed deer, elk, moose, and black bear. The Supplemental EIS addresses four wildlife species that are on the U.S. Fish and Wildlife Service endangered species list: grizzly bear, wolf, bald eagle, and peregrine falcon. Of these, only the grizzly bear is known to inhabit the project area at least part of the time.

The State Forest Land Management Plan (SFLMP) directs DNRC to "take a coarse filter approach to biodiversity by favoring an appropriate mix of stand structures and compositions on state lands" (Montana DNRC ROD, 1996). To implement a coarse-filter approach and meet SFLMP directives, landscape-analysis techniques were used to determine an appropriate mix of stand structures and compositions, including cover-type representation, age-class distribution, structural characteristics, and spatial considerations, such as patch size, shape, and location. The SFLMP directs DNRC to give special consideration to sensitive species when conducting forest management activities. DNRC recognizes that it is impossible to evaluate the effects of proposed actions on all wildlife species and their specific habitats within any given project area. We assume that if landscape patterns and processes similar to those species evolved with are maintained, then the full complement of species will be maintained across the landscape. Under the SFLMP, we manage State trust lands to maintain or restore a semblance of historic conditions, and make reasonable attempts to engage in cooperative planning efforts with major adjacent landowners (DNRC 1996).

Old growth stands cover about 56 percent (2,347 acres) of the project area and 45 percent (17,333 acres) of the SRSF. Old growth patch sizes in the project area average 334 acres. Tree species represented include Douglas-fir, western larch, cedar, western white pine, ponderosa pine, lodgepole pine, englemann spruce, subalpine fir, and whitebark pine. Mixed conifer stands dominated by western red cedar

comprise 874 acres on the SRSF, and 462 acres in the South Lost project area. These forests contain scattered older ponderosa pine on south facing slopes at the western end of the project area. Older white pine and species diverse sapling stands are also components of these old, lower-elevation forests. Moving up in elevation, the predominant western larch/Douglas-fir are interspersed with large proportions of subalpine fir and spruce. In sapling stands at the higher elevations, the predominant subalpine fir and spruce are mixed with a lesser component of western larch, Douglas-fir and whitebark pine. A lack of disturbance, in part due to effective fire suppression in the project area has led to a forest that is older and has a greater representation of shade-tolerant species than would occur under average historical conditions. The potential for large catastrophic fires and losses due to insects and diseases has increased.

Westslope cutthroat trout and bull trout are species of special concern found in the South Fork of Lost Creek. Impacts to these fish should be avoided by compliance with the SMZ rules and the "Immediate Actions for Bull Trout Recovery" agreed to by DNRC and the Governor's Bull Trout Recovery Team in 1994. Monitoring suggests that the water quality of the South Fork of Lost Creek has not been seriously affected by human activity.

TIMBER HARVEST GUIDELINES

Any timber harvest carried out under this proposal would incorporate guidance from the SFLMP Resource Management Standards, the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA), Best Management Practices (BMP), Streamside Management Zone (SMZ) rules, Flathead Basin Commission recommendations, and other laws, rules and regulations.

DNRC adopted the SFLMP in 1996. The SFLMP outlines DNRC's management philosophy for State forested trust lands, and sets out specific Resource Management Standards for 10 resource categories. The SFLMP states:

> *Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream.... In the foreseeable future, timber management will continue to be our primary source of revenue and our primary tool for achieving biodiversity objectives.*

Planning for the South Fork Lost Creek project started before the SFLMP was adopted, so implementation of the SFLMP was phased into the project as it developed. DNRC made all reasonable attempts to incorporate the philosophy and standards of the SFLMP into this project.

DNRC is committed to the provisions of the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA). Beginning in December 1994, DNRC participated with the U.S. Fish and Wildlife Service (USFWS), Flathead National Forest (FNF), and Plum Creek Timber Company in the development of the SVGBCA (USFWS 1995b). The SVGBCA seeks to achieve cooperative management of grizzly bear habitat in the Swan valley where intermingled ownership patterns and differing land management objectives complicate habitat management for a species as wide-ranging as the grizzly bear. The South Fork Lost Creek project area is within the conservation area delineated in the SVGBCA. The agreement is summarized in Chapter 4.

PUBLIC CONCERNS

In December, 1994, DNRC solicited comments from the public on the proposed project. Subsequently, the public raised concerns about the potential impacts of the project on the environment. These concerns are discussed in Chapter 2 of the draft EIS, and were used in developing alternatives. Among the concerns most important to the public were the potential effects on grizzly bears and the character of old growth stands.

The proposed project would minimize impacts to grizzly bears through adherence to the SVGBCA.

Impacts to old growth would be minimized through compliance with the SFLMP, which specifies that DNRC would "seek to maintain or restore old growth forest in amounts at least half the average proportion that would be expected to occur with

natural processes on similar sites." The SFLMP also states, "Within an appropriate analysis area, DNRC would seek to maintain or restore old-growth forest in amounts of at least half the average proportion that would be expected to occur with natural processes on similar sites." Any harvesting under the proposed action would comply with these provisions.

ALTERNATIVES

DNRC's consideration of alternatives began in 1994 when the proposed action was developed. Public comments led to the development of the four alternatives discussed in the draft EIS: the no-action alternative and three timber-harvest alternatives. A fourth timber-harvest alternative was developed in response to concerns raised during the field tour that took place on June 16, 1999. The timber harvest alternatives are intended to emulate many of the ecological functions that would result from unsuppressed wildfire and other natural disturbances. The no-action alternative is included as a baseline for comparing the environmental consequences of the four timber harvest alternatives, and is considered a viable alternative for selection. Silvicultural treatments that would go with each timber-harvest alternative would be intended to promote natural patch sizes, shapes, connectivity, structural diversity and species composition. Mitigating measures common to all timber-harvest alternatives are outlined in Chapter 4 of the draft EIS. The silvicultural treatments that would be employed under the alternatives are described in Chapter 2.

No-action Alternative

ALTERNATIVE A

Alternative A is the no-action alternative. If this alternative were selected, no timber harvesting would occur in the project area. Land management activities, such as timber-harvesting, could be proposed and undertaken in the future following the appropriate level of MEPA review. Management activities, such as fire suppression and road maintenance would continue. Figure 2.1 shows the project area as it would continue to exist under Alternative A.

ALTERNATIVES B, C, D AND E

Guidelines

The following guidelines were used in the development of all of the timber-harvest alternatives:

- The alternatives would not harvest old-growth stands that have been identified as part of the old-growth network. See Chapter 3 for a discussion of the old-growth network.
- Long-term timber productivity would be maintained or enhanced.
- The natural role of wildfire in this area would be emulated through the application of silvicultural treatments to promote natural diversity of stand structure species composition.
- Proposed harvest units would be located adjacent to previously harvested units to create groups of young-age stands, similar to what would occur naturally due to wildfires.
- Road construction would be minimized by location of harvest units and use of logging systems that would require the least amount of road.

Road Management

All of the timber-harvest alternatives would include closure of a 1.3-mile segment of the South Fork Lost Creek road in Sections 3 and 4 of T23N, R17W, where it is close to the South Fork of Lost Creek and presents a potential sediment source. The closed segment would be replaced with a new segment of about 1.7 miles, approximately 100-200 feet up-slope from the existing roadbed.

ALTERNATIVE B

Alternative B would harvest approximately 9.2 MMBF from 523 acres. It would require 1.3 miles of new road to provide access to units 5, 6, 7, 9 and 10 (Figure 2.2).

This alternative incorporates specific criteria developed to address public comments that the proposed project should maintain wildlife habitat, especially

for old-growth-associated species. These criteria were used in determining this alternative's harvest unit design, location and silvicultural treatments:

- Minimize harvesting in high quality old growth stands.
- Maintain wildlife corridors for north-south movement, and along riparian areas.
- Minimize harvesting in the largest blocks of old growth.
- Maintain old growth attributes in harvest units.

Thirteen harvest units are included in this alternative for a total of about 523 acres. Three silvicultural treatments—heavy-reserve, moderate-reserve, light-reserve —would be applied to these units (a thorough discussion of the methods and objectives of the silvicultural treatments follows the discussion of alternatives, later in this chapter).

ALTERNATIVE C

Alternative C would harvest approximately 10.9 MMBF from 607 acres. It would require 1.9 miles of new road to provide access to Units 2, 3, 6, 8 and 10 (Figure 2.3).

This alternative incorporates specific criteria developed to address public comments that the proposed project should maintain existing old growth. These criteria were used in determining this alternative's harvest unit design, location and silvicultural treatments:

- Target, as highest priority for harvesting, stands 149 years or less that have poor tree quality, poor vigor and/or exhibit major insect and disease problems.
- Consider, as a lower priority for harvesting, other stands 149 years or less that have higher tree quality vigor and/or may not exhibit insect and disease problems.
- Maintain an existing low elevation east-west wildlife travel corridor along the South Fork of Lost Creek.
- Maintain north-south wildlife travel corridors between lower and higher elevations within the project area.
- Maintain an existing low elevation north-south wildlife travel corridor on the west side of the project area.

Eighteen harvest units are included in this alternative for a total of about 607 acres. Three silvicultural treatments—heavy-reserve, moderate-reserve, light-reserve—would be applied to these units.

ALTERNATIVE D

Alternative D would harvest approximately 8.3 MMBF from 514 acres. It would require .6 mile of new road to provide access to Units 4 and 5 (Figure 2.4).

This alternative incorporates specific criteria to promote timber productivity in high risk, low vigor stands. These criteria were used in determining harvest unit design, location and silvicultural treatments:

- Harvest only within stands that have the highest risk of value loss through mortality, poor to very poor vigor, poor tree quality and/or exhibit major insect and disease problems.
- Apply silvicultural treatments that would contribute to optimizing future timber productivity within stands treated.
- Harvest priorities and silvicultural treatments would be modified to maintain wildlife travel corridors and contiguous blocks of old stands and old growth, to the extent timber productivity would not be overly compromised.

Eight harvest units are included in this alternative covering a total of about 514.3 acres. Three silvicultural treatments— heavy-reserve, moderate-reserve, light-reserve—would be applied to these units (a thorough discussion of the methods and objectives of the silvicultural treatments follows the discussion of this alternative).

ALTERNATIVE E

Alternative E would harvest approximately 3.5 MMBF from 254 acres. It would require .4 mile of new road to provide access to Unit 5 (Figure 2.5).

This alternative incorporates specific criteria to promote timber productivity and minimize impacts to wildlife and vegetation. These criteria were used in determining harvest unit design, location and silvicultural treatments:

- Provide an alternative that contributes to wider range of alternatives in the SEIS by reducing the volume to be harvested from Alternative D. (See Chapter 1.)
- Harvest within stands that have the highest risk of value loss through mortality, poor to very poor vigor, poor tree quality and/or exhibit major insect and disease problems.
- Apply silvicultural treatments that would contribute to optimizing future timber productivity within stands treated.
- Modify harvest priorities and silvicultural treatments to maintain wildlife travel corridors, further improve wildlife security, and maintain larger contiguous blocks of old-growth forest.

Four harvest units are included in this alternative covering a total of about 245.4 acres. Three silvicultural treatments— heavy-reserve, moderate-reserve, light-reserve—would be applied to these units (a thorough discussion of the methods and objectives of the silvicultural treatments follows the discussion of this alternative).

Permits Required to Implement the Project

1. A Stream Preservation Act Permit (124 permit) is required from DFWP for activities that could affect any fisheries stream.

2. A short-term exemption from Montana's Surface Water Quality Standards (3A Authorization) is needed whenever temporary activities introduce sediment above natural levels into live streams. This permit from the Montana Department of Environmental Quality (DEQ) would be needed for two bridge removals, replacement of a bridge on Cliff Creek, and some culvert installations.

SUMMARY OF ENVIRONMENTAL EFFECTS

The following table summarizes the environmental consequences of the alternatives. The scientific basis for the environmental effects summarized here is discussed in more detail in Chapter 4. Refer to Chapter 4 for a complete understanding of the terms, quantities, and statements presented here.

Table 2.5 Summary of Environmental Effects

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
Forest Conditions					
1. Cover Type * Representation	Continued shift to shade-tolerant species; movement away from appropriate conditions	Increase shade-intolerant species by 236 acres; movement toward appropriate conditions	Increase shade-intolerant species by 309 acres; movement toward appropriate conditions	Increase shade-intolerant species by 142 acres; movement toward appropriate conditions	Increase shade-intolerant species by 14 acres; movement toward appropriate conditions
2. Age Class Distribution and Old Growth in Project Area	Overall increase in old growth over time; movement away from appropriate conditions	Old growth reduced by 130 acres; movement toward appropriate conditions	Old growth reduced by 103 acres; movement toward appropriate conditions	Old growth reduced by 200 acres; movement toward appropriate conditions	Old growth reduced by 4 acres; movement toward appropriate conditions
3. Old Growth Attributes					
3a. Structure	Over time, increase in uneven-age condition	Increase proportion of single-story old growth stands	Increase proportion of single-story old growth stands	Increase proportion of single-story old-growth stands	Negligible effect on old-growth stands
3b. Vigor	Over time, increase number of old-growth stands with poor vigor	Increase amount of old-growth stands at full vigor.	Increase amount of old-growth stands at full vigor.	Increase amount of old-growth stands at full vigor.	Decrease amount of old growth in poor vigor class
3c. Large Trees	Over time, the proportion of large trees will be reduced.	Reduces the proportion of old-growth stands with 'lots' of old trees.	Reduces the proportion of old-growth stands with 'lots' of old trees.	Reduces the proportion of old-growth stands with 'lots' of old trees.	Reduces the proportion of old-growth stands with 'lots' of old trees.
3d. Snags	In the short term, the amount of snags will increase; in the long term, large snags will decrease.	Reduces the proportion of old-growth stands with 'lots' of snags.	Reduces the proportion of old-growth stands with 'lots' of snags.	Reduces the proportion of old-growth stands with 'lots' of snags.	Reduces the proportion of old-growth stands with 'lots' of snags.
3e. Coarse Woody Debris	Over time, the amount of coarse woody debris will increase	Reduces the proportion of old-growth stands with 'lots' of coarse woody debris.	Reduces the proportion of old-growth stands with 'lots' of coarse woody debris.	Reduces the proportion of old-growth stands with 'lots' of coarse woody debris.	Slightly reduces the proportion of old-growth stands with 'lots' of coarse woody debris.

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
3f. Volume	Over time, gross volume in old-growth stands would increase.	Increases the proportion of volume in lower volume classes in old-growth stands.	Increases the proportion of volume in lower volume classes in old-growth stands.	Increases the proportion of volume in lower volume classes in old-growth stands.	Increases the proportion of volume in lower volume classes in old-growth stands.
4. Replacement Old Growth	No development of replacement old stands	Harvests less than 18 acres of replacement age stands.	Harvests less than 18 acres of replacement age stands.	Harvests less than 18 acres of replacement age stands.	Harvests less than 18 acres of replacement age stands.
5. Stand Vigor	Shade-intolerant species crowded out; reduction in vigor over time. Vigor rating 2.69	390 acres raised to full vigor; 133 acres would inprove one vigor class. Vigor rating 2.46	456 acres raised to full vigor; 151 acres would improve one vigor class. Vigor rating 2.46	266 acres raised to full vigor; 248 acres would improve one vigor class. Vigor rating 2.49	18 acres raised to full vigor; 236 acres would improve one vigor class. Vigor rating 2.62
6. Patch Sizes by Cover Type in project area	Decreases below current patch size over time	Large decrease in patch sizes in mixed conifer types	Large decrease in patch sizes in mixed conifer types	Large decrease in patch sizes in subalpine fir types	Large decrease in patch sizes in subalpine fir types
7. Patch Sizes by Age Class in the project area	Increase in old-growth patch size over time	Decrease in average patch size of old growth stands by 55 acres	Decrease in average patch size of old growth stands by 10 acres	Decrease in average patch size of old growth stands by 25 acres	Old-growth patch size is unchanged
8. Patch Shape** by Cover Type in project area	Reduction in complexity of patch shape	Reduction in complexity of patch shape	Reduction in complexity of patch shape	Reduction in complexity of patch shape	Reduction in complexity of patch shape
9. Patch Shape** by Age Class in project area	Decrease in patch shape	No effect on complexity of patch shape	No effect on complexity of patch shape	Increase in complexity of patch shape	Increase in complexity of patch shape
T&E Species (Grizzly Bear)					
1. Open Roads (% entire subunit >1.0 mi/mi ^{2})	28%	25%	25%	25%	25%
2. Open Roads (% DNRC acres >1.0 mi/mi^2)	35%	32%	32%	32%	32%

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
3. Total Roads (% entire subunit >2.0 mi/mi ^{2})	31%	31%	31%	31%	30%
4. Total Roads (% DNRC acres >2.0 mi/mi ^{2})	41%	42%	42%	41%	41%
5. Core Area) (entire subunit post harvest)	38%	39%	39%	40%	40%
6. Core Area (DNRC acres post harvest)	26%	26%	26%	29%	29%
7. Hiding Cover (entire subunit post harvest)	79%	79%	79%	79%	79%
8. Hiding Cover (DNRC acres post harvest)	80%	77%	77%	77%	79%
Big Game (Elk and Mule Deer)					
1. Habitat Effectiveness	75%	68%	70%	70%	71%
2. Thermal Cover (% of winter range, DNRC acres)	47%	39%	47%	36%	39%
3. Elk Security Cover (DNRC acres)	36%	30%	31%	30%	34%

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
Aesthetics					
1. General landscape characteristics *** (Variety = landscapes which are object-rich; Contrast = the degree to which objects are distinguished form one another; Texture = distinctive or identifying feature of the landscape depending on distance	Change would continue due to natural processes. Character of landscape would remain the same.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture, with subtle changes to variety and contrast.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture, with subtle changes to variety and contrast.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture, with subtle changes to variety and contrast.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture, with subtle changes to variety and contrast.
Watershed					
1. Annual runoff South Fork Lost Creek Watershed	1% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10 % allowable increase)	2% increase over natural runoff. (10 % allowable increase)
2. Number of cutting units located within a SMZ.	None	None	None	None	None
3. Existing Sources of Sediment that would be mitigated.	Erosion sources not mitigated.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.	7.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, removal of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
Air Quality					
	No change to existing air quality.	Burning on 523 acres: Temporary reduction in air quality.	Burning on 607 acres: Temporary reduction in air quality.	Burning on 514 acres: Temporary reduction in air quality.	Burning on 254 acres: Temporary reduction in air quality.
Soils					
1. Soil Erosion Potential from Road System	Erosion potential may increase on existing road system.	Decrease erosion potential by implementing mitigation.	Decrease erosion potential by implementing mitigation.	Decrease erosion potential by implementing mitigation.	Decrease erosion potential by implementing mitigation.
2. Soil Impacts: Displacement and Compaction	No change in existing compaction of the area in old skid trails and landings.	Mitigation would limit impacts to about 6% of the harvested acres. Approximately 33 acres would be affected	Mitigation would limit impacts to about 4% of the harvested acres. Approximately 26 acres would be affected	Mitigation would limit impacts to about 7% of the harvested acres. Approximately 36 acres would be affected	Mitigation would limit impacts to about 9% of the harvested acres. Approximately 22 acres would be affected
Sensitive Species					
1. Black-backed Woodpecker	Probability of creation of habitat would remain stable or increase with time, and acreage of potential future habitat would not change	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 523 acres	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 607 acres	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 514 acres	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 254 acres
2. Townsend Big-eared Bat	No change in communal or individual roost site availability	No change in communal roost site availability. Some decrease in availability of individual roost sites	No change in communal roost site availability. Some decrease in availability of individual roost sites	No change in communal roost site availability. Some decrease in availability of individual roost sites	No change in communal roost site availability. Some decrease in availability of individual roost sites

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
3. Boreal Owls	No harvest would occur in boreal owl habitat; 19% of the project area would remain as boreal owl habitat	Harvest would occur on 221 acres of boreal owl habitat; 14% of the project area would remain as boreal owl habitat	Harvest would occur on 276 acres of boreal owl habitat; 13% of the project area would remain as boreal owl habitat	Harvest would occur on 131 acres of boreal owl habitat; 16% of the project area would remain as boreal owl habitat	Harvest would occur on 20 acres of boreal owl habitat; 19% of the project area would remain as boreal owl habitat
4. Fisher	No harvest would occur in preferred fisher habitat. Travel cover would remain available over most of the project area.	No harvest would take place in preferred riparian habitat. Travel cover would be reduced by 393 acres.	No harvest would take place in preferred riparian habitat. Travel cover would be reduced by 477 acres.	No harvest would take place in preferred riparian habitat. Travel cover would be reduced by 503 acres.	No harvest would take place in preferred riparian habitat. Travel cover would be reduced by 248 acres.
5. Lynx	No immediate changes in availability of foraging habitat; Project area in travel cover - 43%; Availability of denning habitat within project area- 22%.	No immediate changes in availability of foraging habitat, but will improve with successful regeneration; Project area in travel cover- 35%; Availability of denning habitat within project area- 20%.	No immediate changes in availability of foraging habitat, but will improve with successful regeneration; Project area in travel cover- 33%; Availability of denning habitat within project area- 20%.	No immediate changes in availability of foraging habitat, but will improve with successful regeneration; Project area in travel cover- 35%; Availability of denning habitat within project area- 17%.	No immediate changes in availability of foraging habitat, but will improve with successful regeneration; Project area in travel cover- 37%; Availability of denning habitat within project area- 21%.
6. Pileated Woodpeckers	No harvest would take place in Pileated habitat. No effects to the habitat.	Potential Pileated habitat would be reduced by 493 acres.	Potential Pileated habitat would be reduced by 475 acres.	Potential Pileated habitat would be reduced by 493 acres.	Potential Pileated habitat would be reduced by 239 acres.

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
Economics					
1. Estimated Total Harvest Volume (MBF)	0.00	9,194	10,900	8,300	3,500
2. Estimated Stumpage Value ($/MBF)	0.00	$74	$49	$86	$60
3. Total $ Value – (Estimated Stumpage Value, FI cost and Development Cost times estimated harvest volume)	0.00	$1,447,228	$1,410,569	$1,422,703	$655,935
4. Total $ Revenue to the State (Estimated Stumpage Value + FI cost times estimated harvest volume)	0.00	$1,107,050	$1,039,969	$1,099,003	$372,435
5. Total $ Return to the Trust	0.00	$680,356	$534,100	$713,800	$210,000

*Indications of increased acreage refer to conditions after harvest and regeneration, either natural or by planting, or both.
**Numbers indicating patch shape refer to an index developed by McGarigal and Marks (1994). The lowest number, 1, refers to a perfectly square patch.
***As noted in the text, harvest units generally will be out of view of the public, or visible only at a distance.

DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)

The draft environmental impact statement was prepared in compliance with the Montana Environmental Policy Act (MEPA). MEPA requires state government to include consideration of environmental impacts into its decision-making process. It also requires agencies to inform the public and other interested parties about proposed projects, environmental impacts that might result, and alternative actions that could achieve project objectives.

DNRC solicited public participation in the South Fork Lost Creek project on December 2, 1994, by distributing a project proposal to interested individuals, landowners, organizations, industries, and agencies. The proposed project also was advertised in the area's newspapers.

The mailing list for parties interested in the project is located in Appendix A of the SEIS.

DNRC evaluated the public comments and used many of them to develop alternative methods of achieving the proposed project. These alternatives, along with the no-action alternative and other information pertaining to the proposed project, were incorporated into the draft EIS, which was circulated to all those known to be interested. Comments were accepted for 30 days, and letters were received from the following groups/individuals:

Friends of the Wild Swan
Montana Wilderness Association
Steve Thompson
Steve and Sue Rolfing

FINAL EIS

After all the public comments on the draft EIS were received and evaluated, DNRC prepared a final EIS,

which consisted primarily of a revision of the draft EIS to incorporate new information based on public and internal comments. It also included DNRC's preferred alternative.

SUPPLEMENTAL EIS

On June 16, 1998, DNRC conducted a field tour of the South Fork Lost Creek project area. The field tour was intended to enable Land Board staffers to visit the project area and better understand the concerns of the informed public. During and following the tour, several concerns were raised by the public, the staffers, and DNRC personnel about sale, which led to the need to produce a Supplemental EIS (SEIS). An account of those concerns can be located in Chapter 1 and the project file. The SEIS was completed in accordance with ARM 36.2.533.

PREFERRED ALTERNATIVE

The South Fork Lost Creek Supplement Environmental Impact Statement (SEIS) includes alternatives modified from those described in the Final Environmental Impact Statement (FEIS). These modifications contribute to some changes in the effects of the alternatives and to the comparison of effects between alternatives. It also includes an additional alternative that contributes to a broader range of alternatives being considered and to a broader range of effects between alternatives.

Alternative D has again been selected as the preferred alternative, although modification of alternatives in the SEIS contributed to reducing differences in effects between alternatives. The advantages of Alternative D over other alternatives is based primarily on Alternative D best meeting the project objectives. Changes in impacts to resources are relatively small.

A. Project Objectives

The objectives of the South Fork Lost Creek Project have not changed from the FEIS, even though the range of alternative ways to meet those objectives has been expanded. Achieving the largest monetary return to the school trust in both the short term and long term remain of importance in identifying a preferred alternative.

The highest, short-term revenue return to the School Trust would continue to result from the modified Alternative D and would generate approximately $713,800. Alternative B would generate approximately $680,356 or 4.7 % less than Alternative D. Even though the margin of error in projecting monetary return may be greater than the difference between Alternative D and B, Alternative D appears to provide a slight advantage over Alternative B. Alternative C would generate 25 % less than Alternative D and Alternative E would generate 71 % less than Alternative D. Alternative C, and particularly Alternatives A and E, do not contribute as effectively to short term return to the School Trust.

Stand vigor may contribute the most directly to maintaining and promoting monetary return to the School Trust through timber harvesting in the long term. Alternative D most effectively reduces the proportion of stands in the poor vigor class post harvest. Stands with poor vigor generally have mortality rates that exceed growth rates and therefore would lose potential revenue to the School Trust in the future. The reduction of stands in the poor vigor class, in Alternative D, may contribute most effectively to meeting the objective of providing for the largest monetary return to the School Trust in the long term.

B. Historical Forest Conditions

The alternatives vary widely in regard to moving existing forest conditions toward desired, future conditions. The desired future conditions are based on maintaining a distribution and proportion of ecological characteristics similar to average historical conditions. These appropriate conditions would contribute to maintaining a healthy, sustainable, biologically diverse forest and promote long term, potential, monetary return to the School Trust.

All of the timber harvest alternatives contribute to moving towards average historical conditions for most of the characteristics analyzed. Each of the alternatives vary in the amount of movement towards appropriate conditions and in the characteristics that are most influenced. None of the timber harvest alternatives provide a clear advantage on overall movement for most characteristics.

Alternative A, the no-action alternative would maintain the forest in a condition furthest from the desired future condition and would contribute to further departure from appropriate conditions in the long term. Alternative A would therefore contribute least effectively to both short-term and long-term monetary return to the trust.

C. Old-Growth Attributes

Timber harvesting in old-growth stands will substantially alter old-growth attributes within stands that are treated. These attributes include stand structure, stand vigor, large trees, snag numbers, coarse woody debris and gross volume per acre. The proportion and distribution of old-growth attributes within the project area will vary between alternatives. However, the more appropriate scale for evaluating old-growth attributes is the SRSF. At that scale harvest effects on old-growth attributes are negligible. The analysis of old-growth attributes, therefore, do not provide a clear basis for identifying a preferred alternative.

D. Wildlife Effects

The analysis of effects on wildlife emphasize that a diversity of wildlife species also have a diversity of habitat needs. Any harvest treatment on any stand will have positive effects on some species while having negative effects on others. What may be more important than how individual species are affected at a stand level is that a diversity of habitat conditions is maintained in appropriate proportions and distributions across the SRSF. The Biological Diversity Guidelines contribute to maintaining appropriate proportions of stand conditions. Although each of the timber harvest alternatives moves the proportion of wildlife habitat characteristics toward appropriate conditions, none provide an overall advantage for most characteristics.

Each of the timber harvest alternatives were also developed around a SRSF old-growth network. The network contributes towards maintaining a distribution of large patches of old-growth and connectivity between patches of old growth to provide a functional old-growth network for wildlife (refer to project file).

Several factors contribute to minimizing differences in effects on wildlife habitat; 1)target stand conditions based on average historical stand conditions; 2) development of alternatives around an old-growth network; and 3) wildlife mitigations common to all timber harvest alternatives. These factors contribute to minimizing differences in effects on wildlife between alternatives. The differences in effects on wildlife do not provide a clear basis for identifying a preferred alternative. As discussed above, Alternative A maintains and promotes forest conditions least similar to average historical conditions and is therefore least preferred.

E. Soils

Although there are minor differences in effects on soils among alternatives, implementation of BMP's would minimize adverse effects to soil from any of the timber harvest alternatives.

F. Watershed

The harvest activities proposed in all timber harvest alternatives would fully comply with BMP's and the Montana SMZ law to minimize the risk of increased sedimentation from harvest units. Proposed restoration projects would lead to a net long-term benefit to water quality by stabilizing existing sources of sediment and improving surface drainage and potential for sediment delivery. Projections from the WATSED indicate water yield would increase from 1 % the existing increase over natural up to 3%. These temporary increases in water yield are minor considering the allowable increase over natural is at 10 %.

G. Fisheries

Decreased acreages proposed for harvest and reduction of road construction in alternative D would lessen the potential impacts to fish spawning habitat, and enhance the benefits of the proposed rehabilitation sites.

H. Air Quality

Direct and cumulative effects of proposed burning in timber harvest alternatives would not exceed limits defined by the Montana Cooperative Smoke Management Plan .

I. Visual Quality

Each of the timber harvest alternatives would have minor impacts on visual quality. It is not clear that overall, effects would be substantially different between harvest alternatives. Some alternatives would have a larger number of light reserve and moderate reserve harvest units. Other Alternatives have fewer but larger harvest units. Screening along roads would somewhat mitigate visual effects. The effects are acceptable in order to promote desired appropriate forest conditions.

J. Recreation

Proposed timber harvesting would probably not eliminate any existing recreation opportunities.

NOTIFICATION OF DECISION

Following publication of the SEIS, the Unit Manager of Swan River State Forest will review all of the information contained in the EIS and project file, including public comments. No sooner than 15 days after the publication of the final EIS, the Unit Manager will consider and determine the following:

1. Do the alternatives presented in the final EIS meet the project purpose?
2. Is the proposed mitigation adequate and feasible?
3. Which alternative should be implemented and why?

These determinations will be published in a decision notice/Record of Decision and distributed to all interested parties.

PROPOSED SCHEDULE OF ACTIVITIES

After the decision is published and if a timber harvest alternative is selected, a contract package would be prepared. The package would then be sent to the Land Board in the winter or spring of 1999 for approval. If the Land Board approves, the timber sale would be advertised. If the timber is sold, then the following schedule applies:

SRSF proposes to sell timber from the proposed project in April 1999. Timber harvesting and road construction/improvement work would begin in the summer of 1999 and be completed by April 15, 2000. Planting and hazard reduction work would be completed within 2 years following completion of harvesting. Some activities would be restricted to certain periods of the year to avoid or reduce impacts (see chapter IV for mitigation information).

CHAPTER 1
INTRODUCTION

Swan River State Forest (SRSF) proposes to harvest timber in the South Fork of Lost Creek drainage to generate revenue for the Montana School Trust (Figure 1.1). SRSF is a branch of the Montana Department of Natural Resources (DNRC). The project area is located approximately 4 miles southeast of Swan Lake, Montana, and includes three full sections and portions of eight others in T24N-R17W, for a total of approximately 4,161 acres. If a harvest alternative is selected, 254 to 607 acres would be harvested with various silvicultural treatments.

I. PURPOSE

In December of 1994, DNRC proposed to harvest 10 MMBF of timber in order to generate revenue through sustainable timber harvesting. The volume target is part of the SRSF's annual contribution to the State's sustained yield harvest of 42 million board feet. The SRSF Stand Level Inventory (SLI) was screened to identify stands classified at risk and recommended for harvest.

In 1996, DNRC adopted the State Forest Land Management Plan (SFLMP 1996). On May 30, 1996, DNRC released the Record of Decision on the SFLMP. The State Board of Land Commissioners approved implementation of the SFLMP on June 17, 1996. The SFLMP outlines DNRC's management philosophy for State forested trust lands, and sets out specific Resource Management Standards for 10 resource categories. The SFLMP states:

> *Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream.... In the foreseeable future, timber management will continue to be our primary source of revenue and our primary tool for achieving biodiversity objectives .*

The land involved in this proposed project is held by the State of Montana in trust for the support of public schools (Enabling Act of February 22, 1889; 1972 Montana Constitution, Article X, Section 11). DNRC and the State Board of Land Commissioners (Land Board) are required by law to administer these trust lands to produce the largest reasonable and legitimate return over the long run (Section 77-1-202, MCA).

II. RELATIONSHIP TO THE STATE FOREST LAND MANAGEMENT PLAN

The SFLMP is a programmatic plan that provides field personnel with consistent policy, direction, and guidance for the management of state forested lands. It contains the general philosophies and management standards that will provide the framework for project-level decisions.

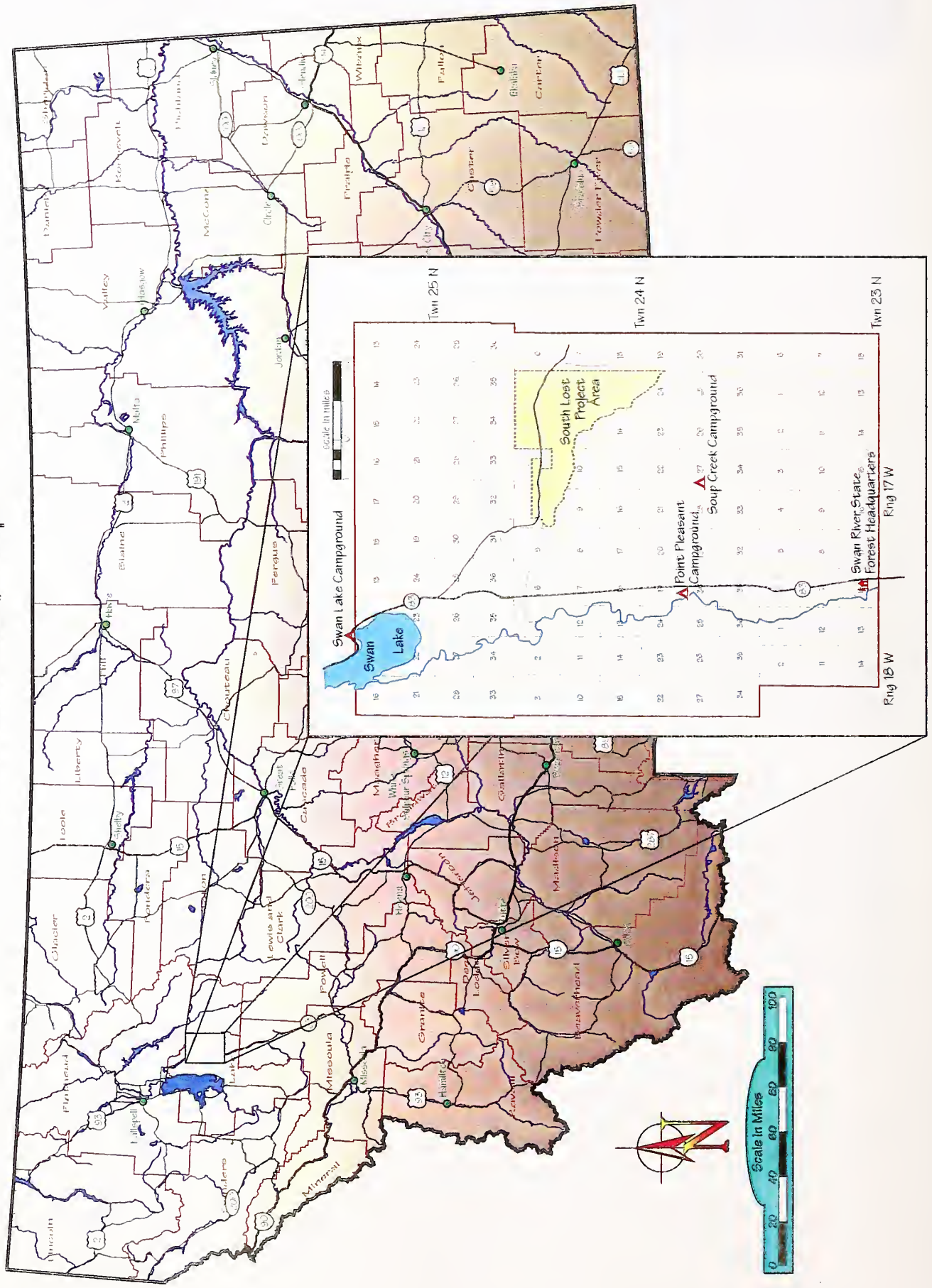
Planning for the South Fork Lost Creek project started before the SFLMP was adopted, so implementation of the SFLMP was phased into the project as it developed. DNRC made all reasonable attempts to incorporate the philosophy and standards of the SFLMP into this project.

III. THE ENVIRONMENTAL IMPACT STATEMENT PROCESS

A. Environmental Impact Statement Development

This environmental impact statement (EIS) was prepared in compliance with the Montana

Figure 1.1 South Fork Lost Creek General Vicinity Map



Environmental Policy Act (MEPA). MEPA requires state government to include consideration of environmental impacts into its decision-making process. It also requires agencies to inform the public and other interested parties about proposed projects, the environmental impacts that might result, and alternative actions that could achieve project objectives.

B. *Public Scoping*

The initial stage of an EIS is the public scoping process, which is used to inform the public that a state agency is proposing an action and to gather comments on the possible impacts of the project. The scope of this EIS was determined by the professional judgement of resource specialists in DNRC and other state and federal agencies, and by comments from the public and other interested parties. (Table 1.1).

DNRC solicited public participation in the South Fork Lost Creek project on December 2, 1994 by distributing a project proposal to interested individuals, landowners, organizations, industries, and agencies.

This project was also advertised in the Kalispell Daily Interlake, the Seeley Lake Pathfinder, and

Table 1.1 Public Scoping Schedule

Date	Public Scoping Schedule
December 1994	The project proposal was mailed to interested individuals, owners of adjacent land, special interest groups, private industry, and federal and state agencies (Appendix A). Paid advertisements were published in local papers. T he advertisements ran from D ecember 7 thru December 11, 1994. A 30-day comment period began.
January 1995	Comments on the proposal were received from: one industry organization, one environmental group, and three members of the public.
Date	**Additional Public Involvement**
January 1995	DNRC reviewed comments and developed issue statements summarizing and incorporating issues raised. These issue statements were then sent to those who commented to ensure that their concerns were accurately represented.
April 1995	DNRC project leaders held a meeting with the foresters from Stoltze Lumber Co. to discuss and clarify their comments.
Date	**Formal Public Review**
October 1997	Draft EIS was issued for public review and comment. Comments were accepted for 30 days.
March 1998	Final EIS was available for public review.
December 1998	Supplemental EIS will be available for public review.
February 1999	The Record of Decision, which identifies and provides a rationale for the selected alternative, will be issued.

the Bigfork Eagle. A commercial ad was published in the Bigfork Eagle on December 7; the Daily Interlake on December 9 and 11; and the Pathfinder on December 8, 1994. DNRC accepted comments on the proposal for 30 days.

The mailing list for parties interested in the project is located in Appendix A. Public scoping comments are summarized in this chapter, with the originals located in Project Files 303 to 307 at the SRSF office.

C. *Draft EIS*

Following scoping, DNRC prepared a draft EIS incorporating public comments relating to issues that could affect the project. Immediately upon publication, the draft EIS was circulated to all those known to be interested. Comments were accepted for 30 days.

D. *Final EIS*

After all the public comments were received and evaluated, DNRC prepared a final EIS, which consisted primarily of a revision of the draft EIS to incorporate new information based on public and internal comments.

E. *Supplemental EIS*

On June 16, 1998, DNRC conducted a field tour of the South Fork Lost Creek project area. The field tour was intended to enable Land Board staff to visit the project area and better understand the concerns of the informed public. During and following the tour, several concerns (listed below) were raised by the public, the Land Board staff, and DNRC personnel about the sale, which led to the need to produce a Supplemental EIS (SEIS):

1. *The South Lost EIS did not include the cumulative effects for the proposed Cilly Creek Sale.* At the time that the South Lost FEIS was completed, alternatives had not yet been developed for the Cilly Creek Timber Sale; therefore, cumulative effects from that proposed sale were not included in the FEIS. Since this concern was raised, DNRC has subsequently withdrawn the proposed Cilly Creek Timber Sale from consideration at this time, thus addressing the concern that cumulative effects were not being addressed.

2. *Selection of Alternative D as the Preferred Alternative may have appeared to be predecisional.* As part of the new old-growth analysis in the SEIS, all of the previous action alternatives have been modified by deleting harvest units, and a new action alternative (Alternative E) was developed. We believe that the modifications to the previous cutting units may contribute to reducing this concern.

3. *The volume objective of 10 MMBF may appear to have restricted development of a reasonable range of alternatives.* As was stated previously, DNRC has developed Alternative E to address this concern. The range of volumes to be harvested by Alternative now ranges from 3.5 MMBF under Alternative E to 10.9 MMBF under Alternative C.

4. *Some of the Land Board staff members were uncomfortable with the analysis of old growth in the FEIS and were concerned as to whether the SFLMP old-growth commitments were being met.* They did not know if the analysis adequately portrayed the effects to old growth and old-growth associated species. In order to address these concerns, DNRC re-inventoried all old-growth stands in the SRSF in July 1998. As part of the new inventory, DNRC collected data on old-growth attributes including: snags, coarse woody debris, levels of decadence, numbers of large live trees, and relative stocking density. This data was analyzed to better display the current condition of old-growth stands on the SRSF and the effects to these old-growth attributes post harvest under each Alternative. DNRC also analyzed the effects to vegetation using procedures outlined in the Biodiversity Guidance dated May 1998. The same analysis procedures were used in the vegetation analysis for the recently completed Cyclone/Coal EIS. Additionally, DNRC performed a more in-depth wildlife analysis, including effects of harvest on old-growth associated species.

5. *The South Lost EIS did not have the full support of all members of the ID team.* While not all members of an ID team must unanimously support the analysis methods or a proposed action in an EIS, we felt it important to disclose the disagreements that existed among members of the South Lost ID team. During the field tour in June, 1998, two ID Team members expressed concern that the old-growth analysis was inadequate. During the months of July and August 1998, the ID Team met several times to discuss concerns and work through disagreements relating to the vegetation analysis. One member of the ID Team (wildlife biologist) continued to have concerns with the vegetation analysis procedures outlined in the Biodiversity Guidance and removed herself from the ID Team. Another DNRC wildlife biologist was enlisted to complete the wildlife analysis for the SEIS. All current members of the ID Team have expressed support for the SEIS. A more in-depth account of this individual's disagreements can be found in the project file, but the major arguments and DNRC's responses will be summarized here.

   a. **"The old growth definition is much broader than other definitions in use, and defines a set of stands that includes many stands that are clearly not old growth as it is commonly understood."**

      Response: Our generic old growth definition was selected to give us a direct comparison to summaries of a 1930s inventory which described age class distribution of the forests of Montana by cover type. This assures us that we are keeping the appropriate amount of old-growth stands on the lands we manage. Because no clear thresholds have been identified that define when a stand becomes old growth any definition of old growth will be arbitrary (Hunter and White 1997). We recognize that a generic definition (ours included) does not capture all the criteria that characterize the popular notion of old growth. Consequently, we collect data and analyze further all classified old growth for its degree of old growthedness. This process follows from suggestions in the literature, specific to old growth forest definitions, that "it is often necessary to make arbitrary distinctions to organize the overwhelming amount of data that characterize a complex world." (Hunter and White 1997), and that an index of old growthedness may be more useful than strict old growth definitions (Spies and Franklin 1988). Basically, our approach identifies a fairly broad list of old-growth stands to assure we won't miss something important, while our attribute analyses insure we identify and keep all the pieces.

      The most commonly referred to old-growth definition for western Montana is the Green *et al.*, a document produced by the USFS in 1992. That document was used by the Flathead National Forest in its Amendment 21 (USDA 1998). Green *et al.* describe a set of minimum stand characteristics required to classify a stand as old growth. Those characteristics are age and number of large trees. Both the Green et al. and the DNRC definitions include a conceptual definition of old growth as containing attributes and characteristics distinguishing them from younger stands, but these concepts do not figure into the stated minimum requirements. When looking solely at minimum criteria, both definitions will classify old growth with very little in the way of old growth attributes or quality. Our process of quantifying attributes helps show that we are not relying solely on minimum criteria or managing our forests for old growth at the minimal end of the continuum.

      Another critique of our approach is that our definition allows many stands to be identified as old growth that have little or no old growth attributes. The data tells a different story. For instance, all of the old growth on the SRSF has been sampled for stand age, decadence, large live trees, snags, coarse woody debris, and volume. One old growth attribute always associated with old growth is that stands are relatively old (Wells *et al.* 1998). It may seem

trivial, but by definition old growth has to be old. All of DNRC's classified old growth is relatively old. Another attribute common to all old-growth definitions involves some degree of decadence. None of the old growth on the SRSF falls into the category of no decadence. Furthermore, analysis of other attributes in all the old growth on the Swan River State Forest shows that only 16 acres of 17,333 classified old growth acres have no large trees, snags, or down-coarse woody debris (the inventory classification of 'none' for the attributes mentioned is not strictly 'zero', it means that the amount necessary to qualify for the next higher category has not been met, rather than there are 'none' for the attributes described). This represent 0.09% of the old growth on the SRSF, hardly an amount that could be construed as 'many stands'. Still, the 0.09% of old growth without large trees, snags, or coarse woody debris contains the two attributes common to all old growth definitions – age and decadence.

b. **"It may be inappropriate to use the climatic section averages for age class distributions by cover type. Until some critical assumptions have been examined and validated as sound, I think we should use historic data for DNRC lands only."**

Response: The critique suggests the SRSF is so different from the climatic section as to be considered unique, and non-representative. However, vegetation can serve as an indicator of complex natural phenomena that are difficult to measure. It is widely accepted that habitat type groups combine sites with similar temperature, and moisture regimes. To substantiate the assertion that the SRSF was truly unique, with vastly different factors controlling productivity, disturbance regimes, and potential vegetation, we would expect the SRSF cover type proportions by HTG to be very different than is exhibited at the broad scale. Let's again, look at some data. The 1930's inventory shows that for the entire Flathead National Forest (roughly equivalent to the Climatic Section) the western larch / Douglas-fir represented 66% of the area in the warm and moist HTG, and for the cool and moist HTG, it represented 41% of the area. Comparing this to the warm and moist and cool and moist habitat type groups (HTG) on the SRSF we see that western larch / Douglas-fir cover types represented 76% and 47% of each HTG, respectively. Clearly, this assessment shows that cover type representation by HTG was roughly equivalent at both the broad scale (the FNF) and at the scale of the SRSF. The assessment supports the fact that the growing conditions (disturbance regimes, climate, soils, topography, etc.) on the SRSF are not unique.

There are other reasons not to use small scale data to determine our old growth commitments. Among them, we need to consider what would happen if one of the very large stand replacement events, relatively common to western Montana, and the Swan Valley had occurred in the time before the 1930s inventory. Such disturbances can easily affect over 100,000 acres. With the SRSF being 40,000 acres it is entirely possible that the entire SRSF would be a single age class of 0 to 39 years old. If such an event had occurred prior to the 1930's inventory, we would not allow any stand on the SRSF to reach maturity, let alone become old growth. We find such a notion unacceptable because we are looking to manage for long-term sustainability.

c. **"Managing for the climatic section average, when DNRC only has control over a small part contributing to the average, is a misapplication of statistical theory."**

Response: The individual with the previous concern has stated that if all ownerships in the climatic section were managed for the average, then the climatic section average would remain the same, but if only one part of the average changes, and that

part originally deviated from the average, then the overall average would change. The argument means little when the size of the SRSF is considered in comparison to the size of the climatic section. Let's assume the 40,000 acre SRSF was 100% old growth and was wiped out in a single disturbance event. The +3 million acre climatic section had 30% old growth. The catastrophic removal of an area the size of the SRSF would reduce the climatic section old growth by only 1%, to 29%.

In addition, the SFLMP (ROD-13 1996) clearly states "…. DNRC would not maintain additional old growth to compensate for loss of old growth on adjoining ownerships."

d. **"We are apparently unable to match current and historic cover type definitions, which casts doubt on the usefulness of the 1930's data."**

Response: We are unclear where this concern comes from since we are able to match current and historic cover type definitions. This concern is possibly a result of misunderstanding how the Biodiversity Guidance defines "appropriate conditions" differently from the 1930s data. We do not use the 1930's inventory to determine our appropriate conditions. That designation is based on categorizing cover types based on the tree species currently present on the site. Emphasis is given to shade intolerant species since they are the ones whose representation on the landscape has been substantially reduced through our activities, fire suppression, timber harvesting, introduced diseases, etc.

F. Notification of Decision

Following publication of the SEIS, the Unit Manager of Swan River State Forest will review all of the information contained in the SEIS and project file, including public comments. No sooner than 15 days after the publication of the Supplemental EIS, the Unit Manager will consider and determine the following:

1. Do the alternatives presented in the final EIS meet the project purpose?
2. Is the proposed mitigation adequate and feasible?
3. Which alternative should be implemented and why?

These determinations will be published in a decision notice/Record of Decision and distributed to all interested parties.

G. Proposed Schedule of Activities

After the decision is published and if a timber harvest alternative is selected, a contract package would be prepared. The package would then be sent to the Land Board in the winter or spring of 1999 for approval. If the Land Board approves, the timber sale would be advertised.

If the timber is sold, then the following schedule applies:

SRSF proposes to sell timber from the proposed project in spring 1999. Timber harvesting and road construction/ improvement work would begin in the summer of 1999 and be completed by April 15, 2000. Planting and hazard reduction work would be completed within 2 years following completion of harvesting. Some activities would be restricted to certain periods of the year to avoid or reduce impacts (see chapter IV for mitigation information).

IV. OVERVIEW OF THE PROJECT

A. *Project Area Boundary*

The criteria used for determination of size and location of the project area are:

- Area had not been entered for any major activity for 10 years.
- The project area would be contained to one Grizzly Bear Management Subunit, in compliance with Swan Valley Grizzly Bear Conservation Agreement (SVGBCA, discussed below) to reduce potential cumulative effects.
- The project would be limited to one watershed, minimizing any potential impacts to water quality and fisheries.
- The project would focus primarily on forest stands recommended for treatment and classified at risk in the SRSF Stand Level Inventory.

The South Fork Lost Creek Project is located in the northeast corner of the Swan River State Forest approximately 4 miles southeast of Swan Lake, Montana (Figure 1-2). The project area is limited to the South Fork of Lost Creek watershed and the South Fork Lost Soup Grizzly Bear Management Unit (BMU).

The project covers 4,161 acres and ranges in elevation from 3,360 feet where South Fork Lost Creek leaves the project area to a 7,238 foot unnamed mountain peak located on the southeastern boundary of the project area. The project area consists of a steep, narrow canyon with rocky cliffs, limited access, avalanche chutes, heavy timbered slopes, subalpine terrain, and riparian areas along the South Fork of Lost Creek and small feeder streams.

The project area is bordered on the north by a high ridge that runs east to west. Another ridge running roughly northwest-to-southeast borders the southern side. The western boundary of the project area lies between the ends of these ridges where they drop down to meet the main valley of the Swan River. The eastern boundary consists of the east boundary of the Swan River State Forest.

V. OTHER ENVIRONMENTAL REVIEWS RELATED TO THE PROJECT

A. *The Swan Valley Grizzly Bear Conservation Agreement*

Beginning in December 1994, DNRC participated in the development of the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA) with the U.S. Fish and Wildlife Service (USFWS), Flathead National Forest (FNF), and Plum Creek Timber Company (USFWS 1995b). The SVGBCA seeks to achieve cooperative management of grizzly bear habitat in the Swan valley where intermingled ownership patterns and differing land management objectives complicate habitat management for a species as wide-ranging as the grizzly bear.

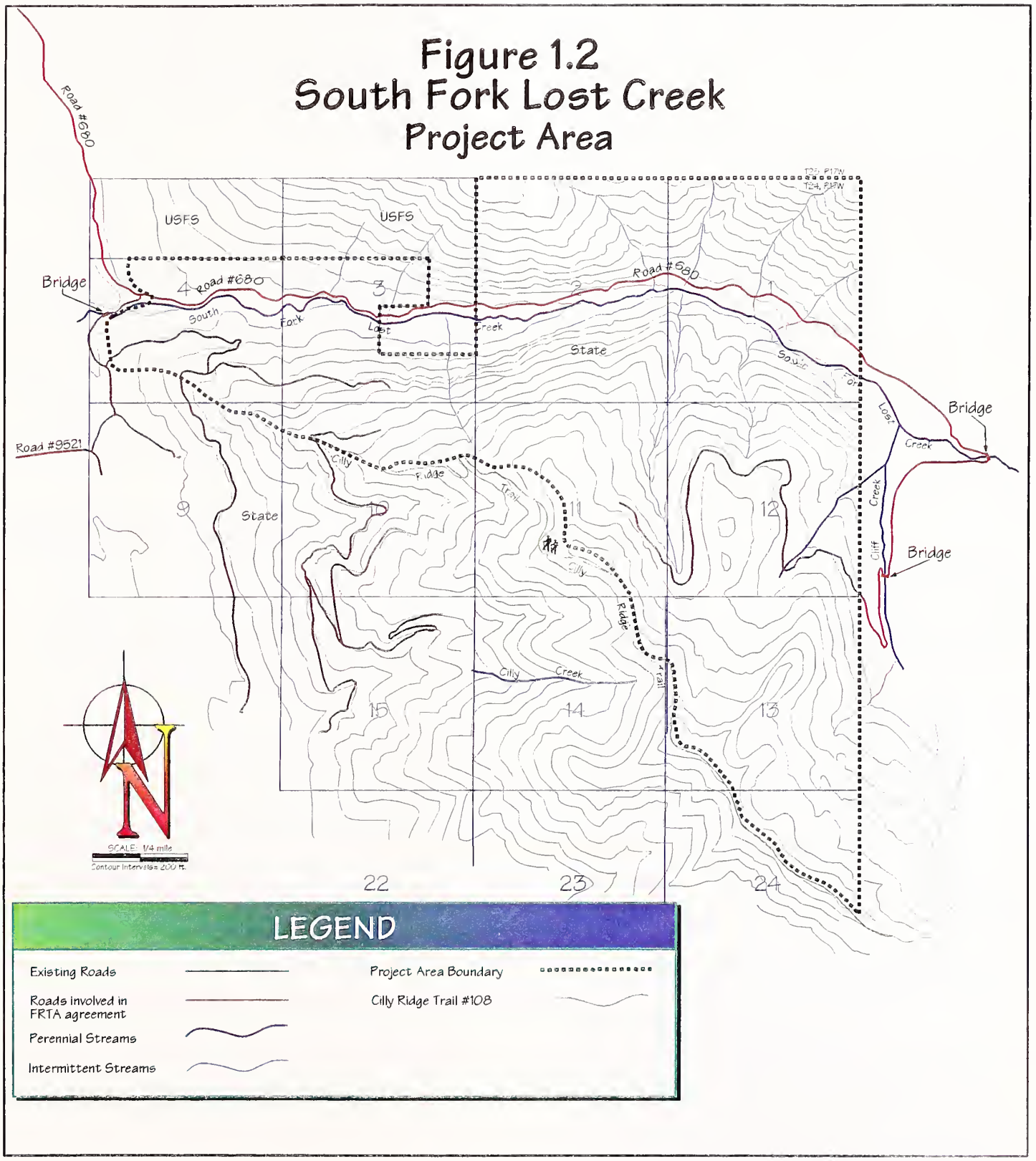
The U.S. Fish and Wildlife Service evaluated the SVGBCA in an environmental assessment and found that implementing the management guidelines in the agreement would not have a significant impact on the grizzly bear population (U.S. Fish and Wildlife Service 1995c). The South Fork Lost Creek Project Area is within the conservation area delineated in the SVGBCA. The agreement is summarized in Chapter 4.

B. *Middle Soup Creek EIS*

The scope of the South Fork Lost Creek EIS is influenced, and the content supplemented, by the Middle Soup EIS (DNRC 1997).

The Middle Soup Creek Project Area is located approximately 4 air-miles southwest of the South Fork Lost Creek Project Area. Effects of the two projects generally would not overlap, except possibly for air quality, and for animals that might move between the two areas, including grizzly bears, wolves, elk, and white-tailed deer (see Chapter 4 for a discussion of cumulative effects).

Figure 1.2 South Fork Lost Creek Project Area



C. *Woodward/Porcupine EIS*

The Woodward/Porcupine Grizzly Bear Subunit has been identified on DNRC's 3-year timber sale list as the next potential project area on the SRSF. At this point in time, DNRC has not developed an initial proposal for this subunit, and subsequently has not identified any objectives or alternatives related to the subunit. This spring, DNRC is planning to convene a collaborative decision-making process with members of the public who would help develop the initial proposal as well as participate in developing alternatives for a project.

VI. OTHER AGENCIES WITH JURISDICTION/ PERMITS REQUIRED

A. *Cooperating Agencies*

1. Department of Fish, Wildlife and Parks (DFWP)

   DNRC has a contract with DFWP to collect data and monitor fisheries habitat and the status of bull trout and west slope cutthroat trout in SRSF streams. This monitoring is required by the Flathead Basin Commission. A DFWP fisheries biologist commented on fisheries in the South Fork of Lost Creek drainage and a DFWP wildlife biologist commented on the proposed project's short-term and long-term effects on white-tailed deer habitat.

2. United States Forest Service (USFS)

   In June of 1995 the Northern Region USFS, the Bureau of Land Management (BLM), and DNRC entered into an agreement which would enable these parties to acquire reciprocal right-of-way easements across ownerships. This Memorandum of Understanding is based on the Federal Land Policy and Management Act of 1976 (as amended) and the National Forest Roads and Trails Act (FRTA) of 1964 (as amended).

   Currently, the Flathead National Forest and the DNRC Northwestern Land Office are in the process of preparing an agreement which would grant the state an easement on USFS Road 9521 (this unnamed road starts 3/4 of a mile east of highway 83 and is accessed from the Cilly Creek Road) (see figure 1.2) and both parties permanent easement rights to USFS Road 680 (South Fork Lost Creek road), which crosses through state and federal land (see Figures 2-2, 2-3 and 2-4 for road locations in each alternative.)

   Included as part of this agreement, both roads would be reconstructed as necessary to meet the state Best Management Practice (BMP) standards for forest roads. Approximately 1.6 miles of USFS Road 680 would be constructed up-slope from its current location along the bank of the South Fork of Lost Creek (see Chapter 3, watershed, for more details).

B. *Permits Required to Implement the Project*

1. A Stream Preservation Act Permit (124 permit) is required from DFWP for activities that could affect any fisheries stream.

2. A short-term exemption from Montana's Surface Water Quality Standards (3A Authorization) is needed whenever temporary activities introduce sediment above natural levels into live streams. This permit from the Montana Department of Environmental Quality (DEQ) would be needed for one bridge replacement, two bridge removals, and some culvert installations.

VII. PUBLIC CONCERNS

Through the scoping process, the public raised concerns about the potential impacts of the project on the environment. DNRC used these public concerns in developing alternatives (see Chapter 2). A paraphrased summation of comments that were incorporated into alternatives is presented below.

A. *Vegetation*

Ecosystem Characteristics The public felt that timber harvesting would reduce the total area of forest, could alter the ecological characteristics of forested stands in the project area, and might reduce the structural and compositional diversities that stands require to function as natural ecosystems. Further, existing stands might be fragmented and edge effects might increase beyond levels acceptable for the maintenance of natural biological diversity.

Old Growth - The public indicated that the character of old-growth stands in the project area might be significantly altered and the connections of those stands with adjacent old-growth stands could be affected. Also, the public felt that timber harvesting might ruin the opportunity to use existing old-growth stands as "outdoor classrooms" where the ecological uniqueness of old growth forests could be studied.

Timber Value - The public commented that mitigation to reduce impacts to resources other than timber might compromise forest productivity and the potential for timber sales to support school trusts.

Special Status Plants - The public felt that timber harvesting might threaten sensitive species such as the water howellia (*Howellia aquatillis*), a threatened aquatic plant that occurs in the Swan valley.

B. *Wildlife*

Grizzly Bear - The public expressed several concerns regarding grizzly bears: a) that previous land management activities may have reduced the grizzly bear population in and around the project area; b) that past road building has increased human use of the area, which could increase bear mortality and displace bears from biologically suitable habitats; and c) that the exclusion of bears from the project area could further isolate grizzly bears in the Mission Mountains.

Elk, Mule deer, and White-Tailed Deer The public indicated that a) timber harvesting could either benefit or harm elk and white-tailed deer populations; b) tree removal might reduce availability of hiding and thermal cover; and c) road construction and improvement might reduce security by increasing vulnerability to hunters.

Old-Growth Associated Species - The public expressed concern that the proposed project might adversely affect wildlife species that are closely associated with old growth.

Cavity-Dependent Species - The public felt that any loss of snags and decayed trees that cavity-dependent species use for nesting, roosting, feeding, and shelter could reduce the populations of such species in the project area.

Fisheries - The public indicated that populations of bull trout and westslope cutthroat trout might be harmed if water quality is affected.

C. *Water Quality*

The public expressed concern that a) timber harvest might increase water yields and sedimentation; b) the quality of water in the immediate area and downstream might be affected; and c) any reduction in water quality would affect fish.

D. *Soil*

The public indicated that timber harvest might cause soil rutting, compaction, displacement, and loss of productivity.

E. Recreation

The public felt that the Cilly Ridge Trail should be protected from the effects of timber harvest.

F. Cultural Resources

The public expressed concern that timber harvest might cause irreparable harm to any historical or archaeological resources in the project area.

VIII. ISSUES OUTSIDE THE SCOPE OF THIS PROJECT

The following concerns were evaluated and would not be affected by the project for the reasons stated.

A. Cultural Resources

A DNRC archaeologist examined the project area for historical or archaeological resources but none were found. Mitigating measures would be implemented if any such resources were found during further examination or during project activities (See Chapter 4).

CHAPTER 2
ALTERNATIVES

I. DEVELOPMENT OF ALTERNATIVES

Development of alternatives began in December 1994 when DNRC developed a project proposal describing the proposed action and project timeline. The proposal was sent for review and comment to interested members of the public, adjacent landowners, and other state and federal agencies. Comments were accepted for a 30-day period.

An interdisciplinary team (ID team) was formed to work on the project. The role of the ID team was to develop the project and analyze the potential impacts on the human and natural environment. The ID team reviewed the comments that were received and used them in developing three timber-harvest alternatives and a no-action alternative for the DEIS and FEIS. The alternatives that were developed for the FEIS were modified for the SEIS, and an additional action alternative was developed for the SEIS to address concerns raised during the field tour held in June 1998 (see Ch. 1). The timber-harvest alternatives are intended to emulate many of the ecological functions that would result from unsuppressed wildfire and other natural disturbances. Silvicultural treatments are intended to promote natural patch sizes, shapes, connectivity, structural diversity and species composition. The timber-harvest alternatives incorporate guidance from the State Forest Land Management Plan (SFLMP) Resource Management Standards, the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA), Best Management Practices (BMP), Streamside Management Zone (SMZ) rules, Flathead Basin Commission recommendations, and other laws, rules and regulations.

The no-action alternative is included as a baseline for comparing the environmental consequences of the four timber-harvest alternatives. The no-action alternative is considered a viable alternative for selection.

II. ALTERNATIVES

This section describes the no-action alternative and the four action alternatives. Mitigating measures common to all timber-harvest alternatives are outlined in Chapter 4.

A. NO-ACTION ALTERNATIVE

ALTERNATIVE A

Alternative A is the no-action alternative. If this alternative were selected, no timber harvesting would occur in the project area. Land management activities, such as timber-harvesting, could be proposed and undertaken in the future following the appropriate level of MEPA review. Management activities, such as fire suppression and road maintenance would continue. Figure 2.1 shows the project area as it would continue to exist under Alternative A.

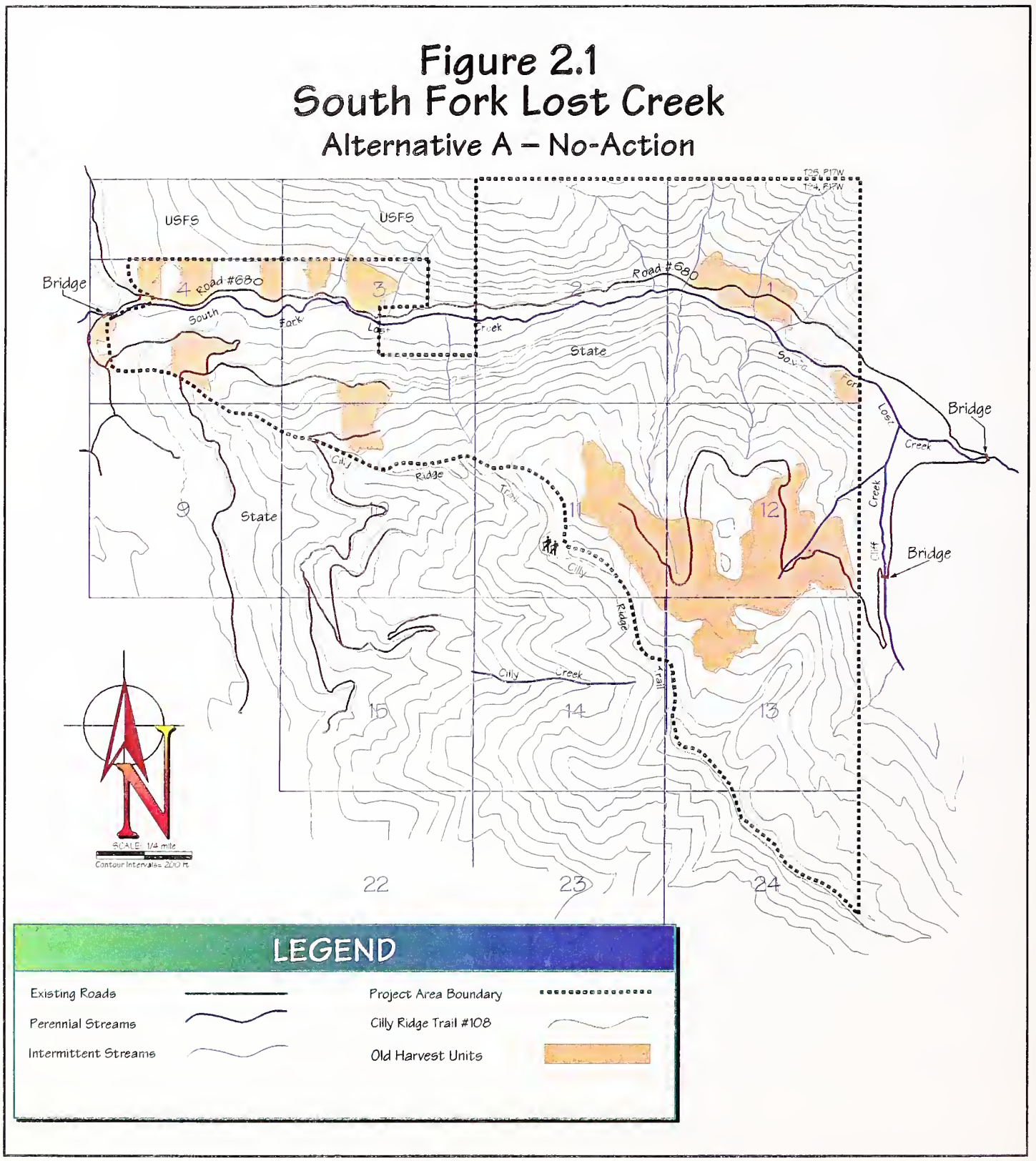
B. TIMBER-HARVEST ALTERNATIVES

Guidelines

The following guidelines were used in the development of all of the timber-harvest alternatives:

- The alternatives would not harvest old-growth stands that have been identified as part of the old-growth network. See Chapter 3 for a discussion of the old-growth network.
- Long-term timber productivity would be maintained or enhanced.
- The natural role of wildfire in this area would be emulated through the application of silvicultural treatments to promote natural diversity of stand structure species composition.
- Proposed harvest units would be located

Figure 2.1 South Fork Lost Creek Alternative A



adjacent to previously harvested units to create groups of young-age stands, similar to what would occur naturally due to wildfires.
- Road construction would be minimized by location of harvest units and use of logging systems that would require the least amount of road.

Road Management

All of the timber-harvest alternatives would include closure of a 1.7-mile segment of the South Fork Lost Creek road in Sections 3 and 4 of T23N, R17W, where it is close to the South Fork of Lost Creek and presents a potential sediment source. The closed segment would be replaced with a new segment of about 1.7 miles, approximately 100-200 feet up-slope from the existing roadbed.

ALTERNATIVE B

Alternative B would harvest approximately 9.2 MMBF from 523 acres. It would require 1.3 miles of new road to provide access to units 5, 6, 7, 9 and 10 (Figure 2.2).

This alternative incorporates specific criteria developed to address public comments that the proposed project should maintain wildlife habitat, especially for old-growth-associated species. These criteria were used in determining this alternative's harvest unit design, location and silvicultural treatments:

- Minimize harvesting in high quality old growth stands.
- Maintain wildlife corridors for north-south movement, and along riparian areas.
- Minimize harvesting in the largest blocks of old growth.
- Maintain old growth attributes in harvest units.

Thirteen harvest units are included in this alternative for a total of about 523 acres. Three silvicultural treatments—heavy-reserve, moderate-reserve, light-reserve —would be applied to these units (a thorough discussion of the methods and objectives of the silvicultural treatments follows the discussion of alternatives, later in this chapter).

Heavy-reserve

The heavy-reserve treatment would be applied to units 5, 9a, 13b and 14b. These units are currently stocked with Douglas-fir, western larch, cedar, subalpine fir and spruce.

- Unit 5 (117 acres) would receive heavy-reserve treatment to help maintain the integrity of an existing north-south wildlife corridor.
- Unit 9b is an 8-acre section of Unit 9 that would be treated with heavy-reserve to retain visual screening for grizzly bears. This is required to comply with the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA).
- Units 13b (.7 acres) and 14b (6.5 acres) would be treated with heavy reserve to leave visual screening along the South Fork Lost Creek road.

Moderate-reserve

The moderate-reserve treatment would be applied to Units 1, 3, 4, 6, 7, 11, 12, 13a and 14a. These units are stocked with Douglas-fir, Douglas-fir/larch, mixed-conifer, cedar, subalpine fir and spruce.

- Units 1, 3 and 4 (totaling 78.1 acres) were identified through the Stand Level Inventory (SLI) as high risk and fair-to-poor/very poor vigor. These units were selected for moderate-reserve treatment to improve stand productivity by removing competing trees to promote regeneration of western larch, Douglas-fir and western white pine. The location of these stands would help maintain the integrity of large contiguous blocks of old growth.
- Units 6 and 7 (totaling 96.1 acres) were placed around previously harvested cutting units to minimize fragmentation.
- Units 11, 12, 13a and 14a (totaling 111 acres) were selected for harvest to remove competing tree species and promote regeneration of western larch, Douglas-fir and white pine.

Light-reserve

The light-reserve treatment would be applied to Units 9b, 10 and 16. These units are currently stocked with Douglas-fir, subalpine fir and spruce.

- Units 9a and 10 (totaling 60.7 acres) were placed around existing harvest units to minimize fragmentation.
- Unit 16 (44.5 acres) was selected for light-reserve treatment to convert the existing cover type to western larch and western white pine in order to move towards appropriate conditions.

Figure 2.2 South Fork Lost Creek Alternative B

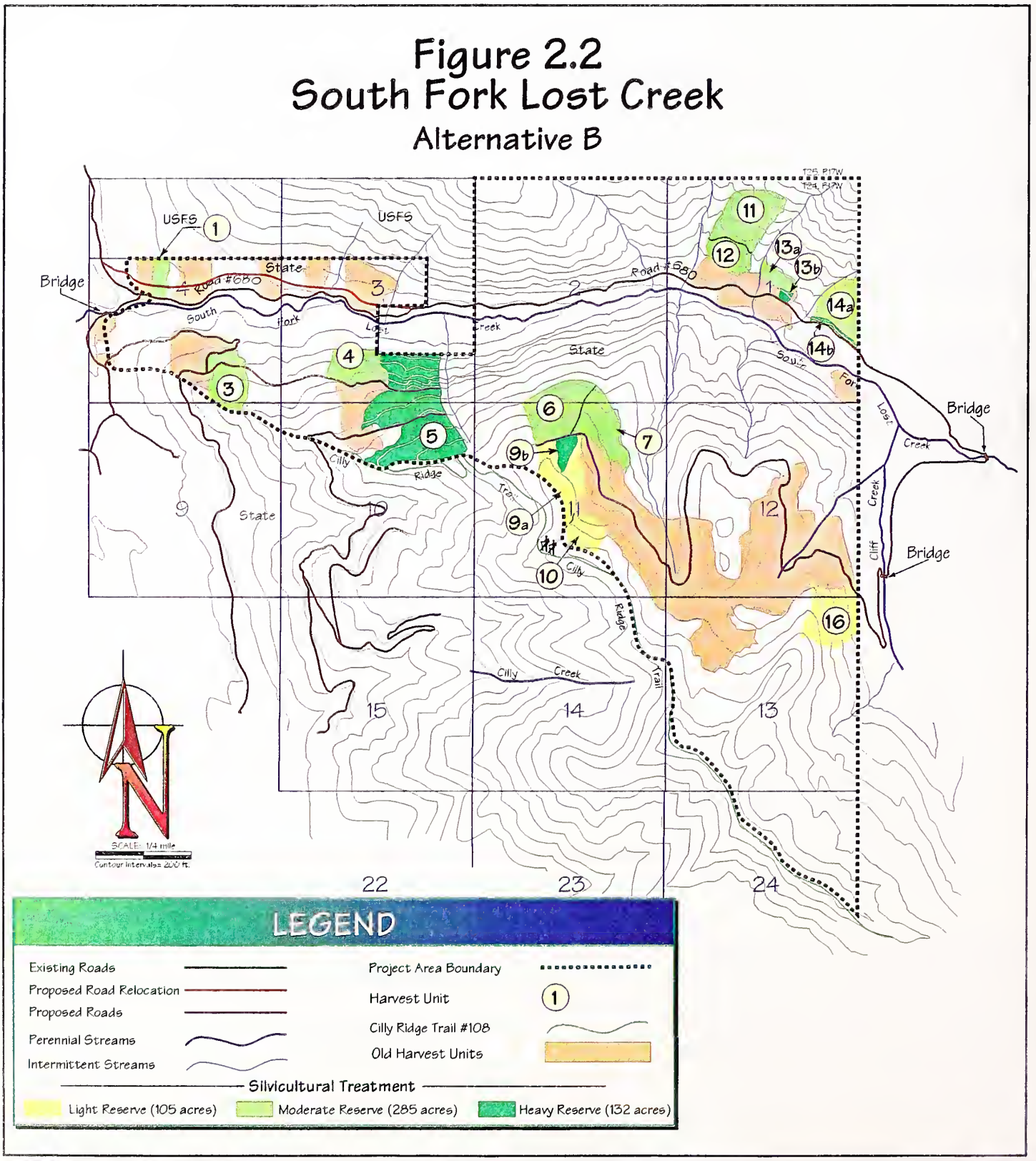


Table 2.1 Alternative B Summary

ALTERNATIVE B SUMMARY						
UNIT #	TOTAL ACRES	TREATMENT	HARVEST METHOD & ACRES	HARVEST VOLUME (MBF)	SITE PREPARATION	REGENERATION METHOD AND SPECIES (*and/or)
1	10.5	Moderate Reserve	Tractor	132.5	Machine Pile & Scarification	Plant: PP
3	36.7	Moderate Reserve	Soft track/ Cable	969.4	Broadcast Burn	Plant: WL * WP
4	30.9	Moderate Reserve	Cable/ Heli	462.4	Broadcast Burn	Plant: WL * WP
5	117.4	Heavy Reserve	Soft Track/ Cable	1613.1	Machine Pile & Burn , Broadcast Burn or lop and scatter	Natural or Plant: WL * WP
6	54.7	Moderate Reserve	Cable	1660.0	Broadcast Burn	Plant: WL * DF, LP
7	41.4	Moderate Reserve	Cable	825.1	Broadcast Burn	Plant: WL * WP
9a	41.8	Light	Tractor	780.9	Machine Pile & Scarification	Natural or Plant: WL * LP
9b	8	Heavy				
10	18.9	Light Reserve	Soft Track	212.7	Machine Pile & Scarification	Plant: WL * LP
11	50.3	Moderate Reserve	Heli	854.4	Broadcast Burn	Plant: WL * WP, LP
12	19.6	Moderate Reserve	Soft Track	352.3	Machine Pile & Scarification	Plant: WL * WP, PP
13a	12.0	Moderate	Soft Track	218.6	Machine Pile & Scarification	Natural or Plant: WL * WP, PP
13b	.7	Heavy				
14a	29.1	Moderate	Heli/ Soft Track	483.7	Machine Pile & Scarification & Broadcast Burn	Natural or Plant: WL * WP, LP
14b	6.5	Heavy				
16	44.5	Light Reserve	Heli	628.7	Broadcast Burn	Plant: WL * WP
Total Acres Treated	523			9193.8		

PP=Ponderosa Pine LP=Lodge Pole WL=Western Larch WP= White Pine

ALTERNATIVE C

Alternative C would harvest approximately 10.9 MMBF from 607 acres. It would require 1.9 miles of new road to provide access to Units 2, 3, 6, 8 and 10 (Figure 2.3).

This alternative incorporates specific criteria developed to address public comments that the proposed project should maintain existing old growth. These criteria were used in determining this alternative's harvest unit design, location and silvicultural treatments:

- Target, as highest priority for harvesting, stands 149 years or less that have poor tree quality, poor vigor and/or exhibit major insect and disease problems.
- Consider, as a lower priority for harvesting, other stands 149 years or less that have higher tree quality vigor and/or may not exhibit insect and disease problems.
- Maintain an existing low elevation east-west wildlife travel corridor along the South Fork of Lost Creek.
- Maintain north-south wildlife travel corridors between lower and higher elevations within the project area.
- Maintain an existing low elevation north-south wildlife travel corridor on the west side of the project area.

Eighteen harvest units are included in this alternative for a total of about 607 acres. Three silvicultural treatments—heavy-reserve, moderate-reserve, light-reserve—would be applied to these units.

Heavy-reserve

The heavy-reserve treatment would be applied to Units 7, 12b, 17b and 18. These units are currently stocked with Douglas-fir, grand fir, cedar, subalpine fir and spruce.

- Units 7 and 18 (totaling 144.5 acres) would receive heavy-reserve treatment to create openings that would promote growth and natural regeneration of shade-intolerant tree species.
- Units 12b and 17b (totaling 6.8 acres) would be treated so as to leave visual screening along the South Fork Lost Creek road.

Moderate-reserve

The moderate-reserve treatment would be applied to Units 1, 2, 3, 4, 5, 6, 12a, 13, 14, 15, 16, and 17a. These units are stocked with Douglas-fir, mixed-conifer, cedar, subalpine fir and grand fir.

- Units 1, 2, 5, and 6 (totaling 63.6 acres) were identified through the SLI as high risk and fair-to-poor/very poor vigor. These units were selected for moderate-reserve treatment to improve productivity by removing competing trees and promoting regeneration of western larch, Douglas-fir, lodgepole pine and western white pine. Units 1 and 2 were located next to previously harvested cutting units to reduce fragmentation.
- Units 3, 4, 12a, 13, 14, 15, 16 and 17a (totaling 298.5 acres) were selected for moderate-reserve treatment to improve the vigor of the stands by removing competing trees and promote regeneration of western larch, Douglas-fir, lodgepole pine and western white pine. Unit 13 was located next to a previously harvested cutting unit to reduce fragmentation.

Light-reserve

The light-reserve treatment would be applied to Units 8, 9, 10, and 11. These units are currently stocked with Douglas-fir, subalpine fir and spruce.

- Units 8 and 9 (totaling 70.3 acres) were placed around previously harvested units to minimize forest fragmentation. They were selected for light-reserve treatment to convert the existing cover type to western larch and Douglas-fir.
- Units 10 and 11 (totaling 23.3 acres) were selected for light-reserve treatment to convert the existing cover type to western larch and Douglas-fir.

Figure 2.3 South Fork Lost Creek Alternative C

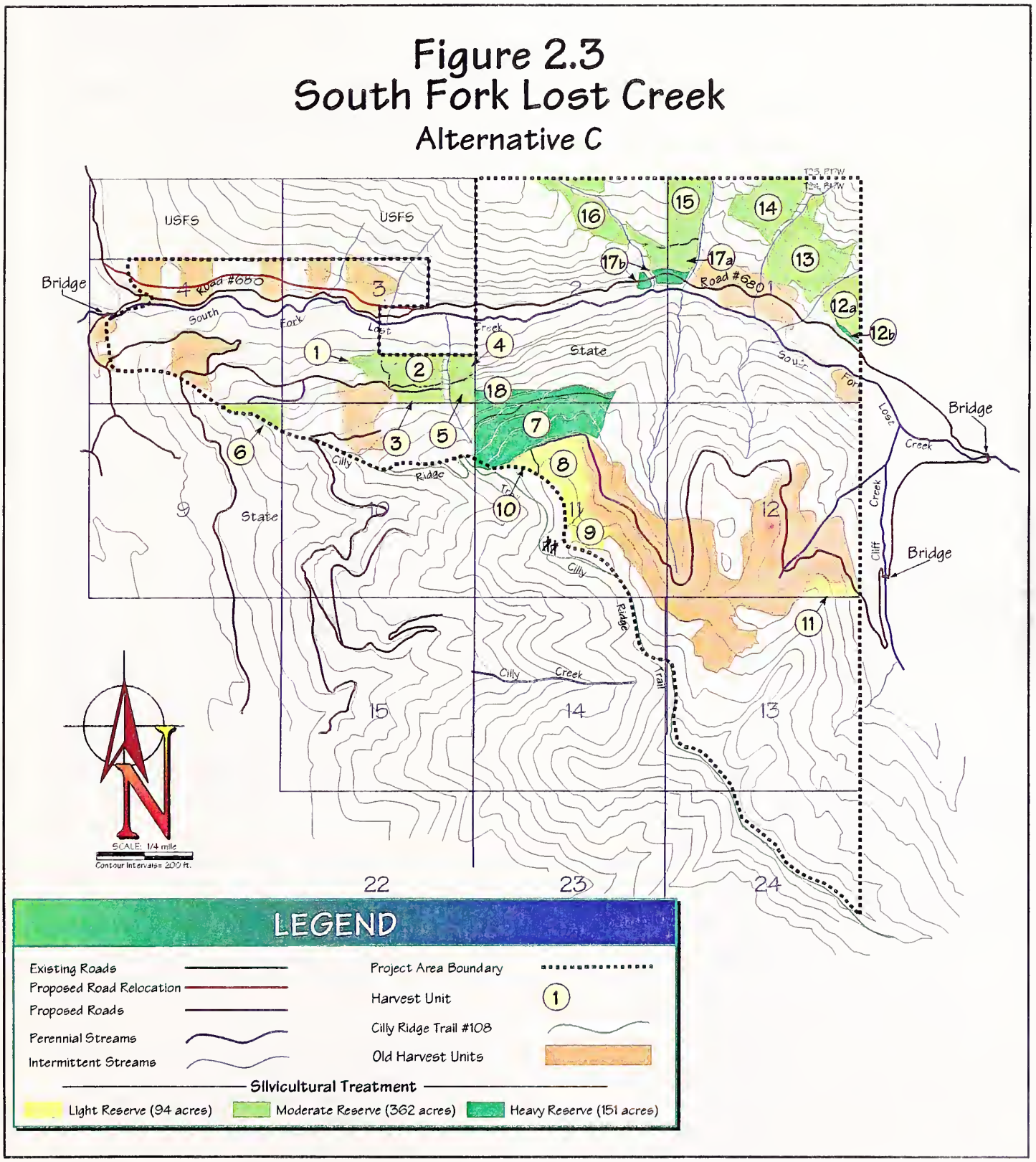


Table 2.2 Alternative C Summary

ALTERNATIVE C SUMMARY						
UNIT #	TOTAL ACRES	TREATMENT	HARVEST METHOD	HARVEST VOLUME (MBF)	SITE PREPARATION	REGENERATION METHOD AND SPECIES (* and/or)
1	12.7	Moderate Reserve	Cable	76.1	Broadcast Burn	Plant: WL * WP
2	28.0	Moderate Reserve	Cable	532.4	Broadcast Burn	Plant: WL * WP
3	16.7	Moderate Reserve	Soft Track	527.3	Machine Pile & Scarification	Plant: WL * WP
4	10.0	Moderate Reserve	Heli	190.2	None	Plant: WL * WP
5	10.7	Moderate Reserve	Heli	202.8	None	Plant: WL * WP
6	12.2	Moderate Reserve	Soft Track	232.4	Machine Pile & Scarification	Plant: WL * WP
7	100.5	Heavy Reserve	Cable	2,213.7	None	Natural or Plant: WL * DF, LP
8	51.4	Light Reserve	Tractor	912.0	Machine Pile & Scarification	Plant: WL * LP
9	18.9	Light Reserve	Tractor	212.7	Machine Pile & Scarification	Plant: WL * LP
10	8.2	Light Reserve	Tractor	233.7	Machine Pile & Scarification	Plant: WL * LP
11	15.1	Light Reserve	Soft Track	323.3	Machine Pile & Scarification	Plant: WL * WP
12a	27.1	Moderate	Heli	332.3	Broadcast Burn	Natural or Plant: WL * WP, LP
12b	.9	Heavy				
13	81.4	Moderate Reserve	Heli	1,383.7	Broadcast Burn	Plant: WL * WP, LP
14	52.0	Moderate Reserve	Heli	884.7	None	Plant: WL * WP, LP
15	40.9	Moderate Reserve	Heli	890.5	Broadcast Burn	Plant: WL * WP, LP
16	47.0	Moderate Reserve	Heli	693.4	None	Plant: WL * LP
17a	23.4	Moderate	Soft Track	462.7	Machine Pile & Scarification	Natural or Plant: WL * WP
17b	5.9	Heavy				
18	44.0	Heavy Reserve	Heli	595.2	None	Natural or Plant WL * LP
Total Acres Treated	607			10899.1		

PP=Ponderosa Pine WL=Western Larch P=White Pine LP=Lodgepole

ALTERNATIVE D

Alternative D would harvest approximately 8.3 MMBF from 514 acres. It would require .6 mile of new road to provide access to Units 4 and 5 (Figure 2.4).

This alternative incorporates specific criteria to promote timber productivity in high risk, low vigor stands. These criteria were used in determining harvest unit design, location and silvicultural treatments:

- Harvest only within stands that have the highest risk of value loss through mortality, poor to very poor vigor, poor tree quality and/or exhibit major insect and disease problems.
- Apply silvicultural treatments that would contribute to optimizing future timber productivity within stands treated.
- Harvest priorities and silvicultural treatments would be modified to maintain wildlife travel corridors and contiguous blocks of old stands and old growth, to the extent timber productivity would not be overly compromised.

Eight harvest units are included in this alternative covering a total of about 514.3 acres. Three silvicultural treatments— heavy-reserve, moderate-reserve, light-reserve—would be applied to these units (a thorough discussion of the methods and objectives of the silvicultural treatments follows the discussion of this alternative).

Heavy-reserve

The heavy-reserve treatment would be applied to Units 3, 5 and 9b. These units are currently stocked with Douglas-fir, mixed conifer and cedar.

- Units 3 and 5 (totaling 236.4 acres) were identified through the SLI as high risk and fair-to-poor/very poor vigor and were located next to previously harvested units to reduce forest fragmentation and to minimize impact to existing north-south wildlife travel corridors. These units would receive heavy reserve treatment to create openings that would promote growth and natural regeneration of shade intolerant tree species.
- Unit 9b (11.8 acres) would be treated with heavy-reserve to leave visual screening along the South Fork Lost Creek road.

Moderate-reserve

The moderate-reserve treatment would be applied to Units 2, 4, 7 and 9a. These units are stocked with Douglas-fir, western larch, cedar, and grand fir.

- Units 2, 4 and 7 (totaling 80.5 acres) were identified through the SLI as high risk and fair-to-poor/very poor vigor. Unit 2 was located between two previously harvested cutting units to reduce fragmentation. These three units were selected for moderate-reserve treatment to emulate a moderate intensity stand replacing fire. This treatment was selected to improve growth and regeneration of Douglas-fir, western larch and cedar, and to address outbreaks of bark beetle, blister rust and Indian paint fungus.
- Unit 9a (17.1 acres) was selected for moderate-reserve treatment to improve the vigor of the stands and promote regeneration of western larch, Douglas-fir and cedar by removing competing trees.

Light-reserve

The light-reserve treatment would be applied to Units 6 and 10. These units are currently stocked with grand fir, spruce, western larch and Douglas-fir.

- Units 6 and 10 (totaling 168.5 acres) were placed around previously harvested units to minimize fragmentation of the forest. They were selected for light-reserve treatment to emulate a high-intensity, stand replacing fire that would convert the existing cover type to western larch and Douglas-fir, and to address outbreaks of bark beetle, white pine blister rust and Indian paint fungus.

Figure 2.4 South Fork Lost Creek Alternative D

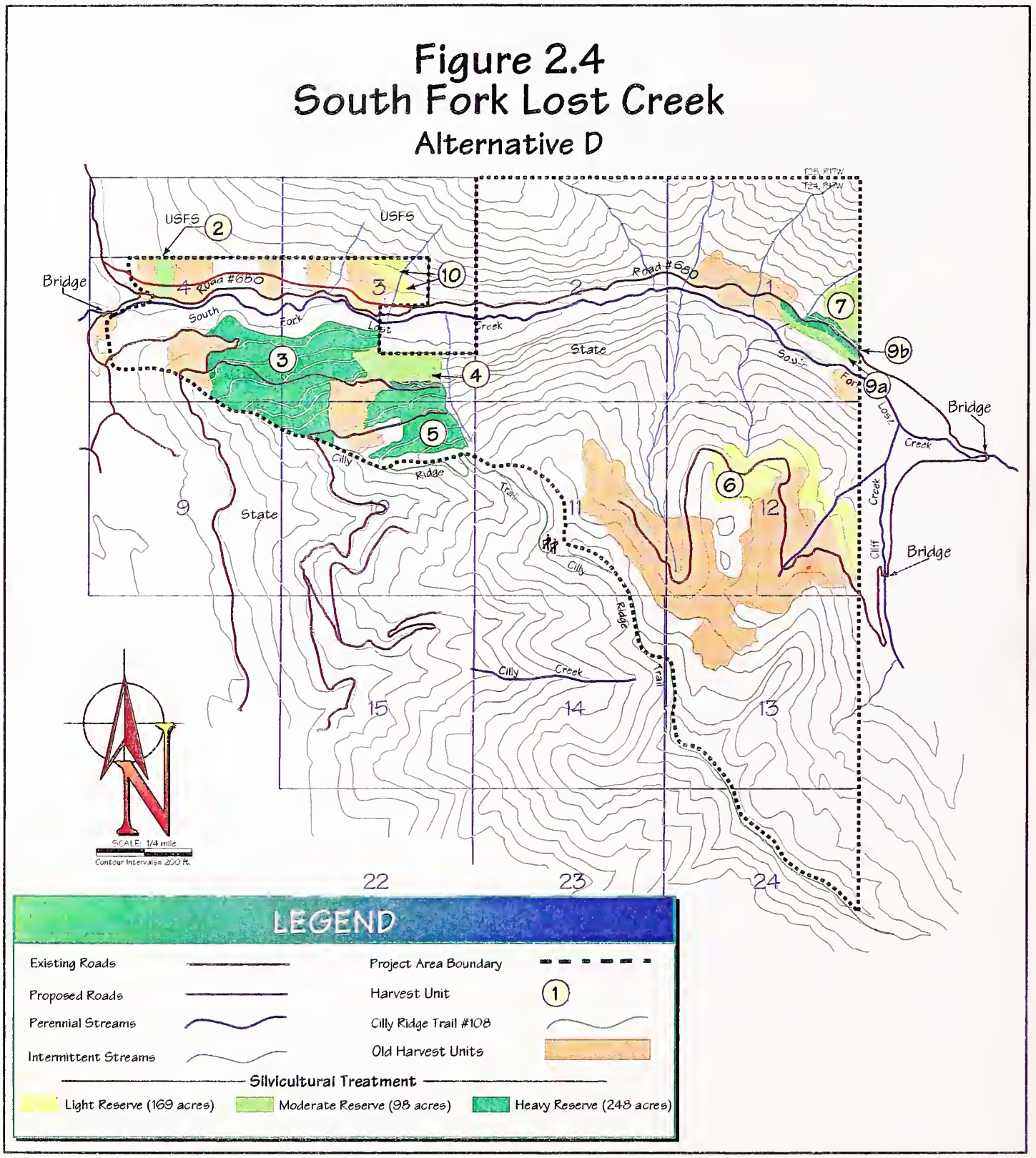


Table 2.3 Alternative D Summary

ALTERNATIVE D SUMMARY						
UNIT #	TOTAL ACRES	TREATMENT	HARVEST METHOD	HARVEST VOLUME (MBF)	SITE PREPARATION	REGENERATION METHOD AND SPECIES (*and/or)
2	10.2	Moderate Reserve	Tractor	120.8	Machine Pile & Scarification	Plant: PP
3	190.8	Heavy Reserve	Tractor & Cable	2762.6	Machine Pile & Scarification	Natural or Plant: WL * WP
4	42.9	Moderate Reserve	Cable/ Soft Track	743.7	Broadcast Burn	Plant: WL * WP
5	45.6	Heavy Reserve	Soft Track	644.5	Machine Pile & Scarification	Natural or Plant: WL * WP
6	143.8	Light Reserve	Tractor/ Cable/Heli	2598.3	Machine Pile & Burn & Broadcast Burn	Plant: WL * WP
7	27.4	Moderate Reserve	Heli	428.1	Broadcast Burn	Plant: WL * WP, LP
9a	17.1	Moderate	Tractor	627.4	Machine Pile & Scarification	Plant: WL * WP
9b	11.8	Heavy Reserve				
10	24.7	Light Reserve	Soft Track	340.7	Machine Pile & Scarification	Plant: PP
Total Acres Treated	514.3			8266.1		

PP=Ponderosa Pine WL=Western Larch WP=White Pine

ALTERNATIVE E

Alternative E would harvest approximately 3.5 MMBF from 254 acres. It would require .4 mile of new road to provide access to Unit 5 (Figure 2.5).

This alternative incorporates specific criteria to promote timber productivity and minimize impacts to wildlife and vegetation. These criteria were used in determining harvest unit design, location and silvicultural treatments:

- Provide an alternative that contributes to wider range of alternatives in the SEIS by reducing the volume to be harvested from Alternative D. (See Chapter 1.)
- Harvest within stands that have the highest risk of value loss through mortality, poor to very poor vigor, poor tree quality and/or exhibit major insect and disease problems.
- Apply silvicultural treatments that would contribute to optimizing future timber productivity within stands treated.

- Modify harvest priorities and silvicultural treatments to maintain wildlife travel corridors, further improve wildlife security, and maintain larger contiguous blocks of old-growth forest.

Four harvest units are included in this alternative covering a total of about 245.4 acres. Three silvicultural treatments— heavy-reserve, moderate-reserve, light-reserve—would be applied to these units (a thorough discussion of the methods and objectives of the silvicultural treatments follows the discussion of this alternative).

Heavy-reserve

The heavy-reserve treatment would be applied to Units 3 and 5. These units are currently stocked with Douglas-fir, mixed conifer and cedar.

- Units 3 and 5 (totaling 236.4 acres) were identified through the SLI as high risk and fair-to-poor/very poor vigor and were located next to previously harvested units to reduce forest fragmentation and to minimize impact to existing north-south wildlife travel corridors. These units would receive heavy reserve treatment to create openings that would promote growth and natural regeneration of shade intolerant tree species.

Moderate-reserve

The moderate-reserve treatment would be applied to Unit 2. This unit is stocked with Douglas-fir, western larch, and grand fir.

- Unit 2 (totaling 10.2 acres) was identified through the SLI as high risk and fair-to-poor vigor. Unit 2 was located between two previously harvested cutting units to reduce fragmentation. This unit would emulate a moderate intensity stand replacing fire. This treatment was selected to improve growth and regeneration of Douglas-fir, western larch, and ponderosa pine and to address outbreaks of bark beetle, blister rust and Indian paint fungus.

Light-reserve

The light-reserve treatment would be applied to Unit 10. This unit is currently stocked with grand fir, western larch and Douglas-fir.

- Unit 10 (totaling 7.8 acres) was placed around previously harvested units to minimize fragmentation of the forest. It was selected for light-reserve treatment to emulate a high-intensity, stand replacing fire that would convert the existing cover type to western larch and Douglas-fir, and to address outbreaks of bark beetle, white pine blister rust and Indian paint fungus.

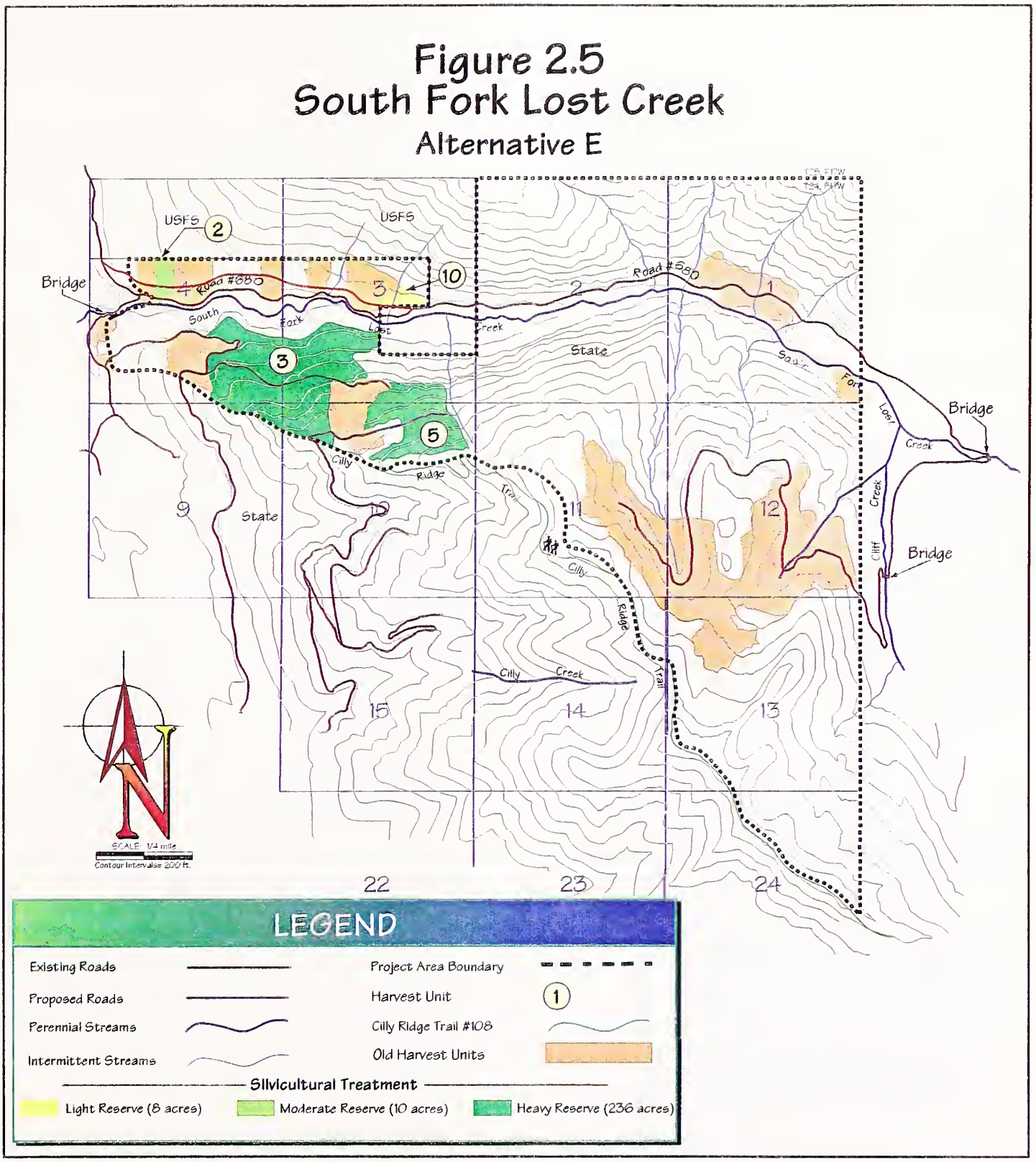
Table 2.4 Alternative E Summary

ALTERNATIVE E SUMMARY

UNIT #	TOTAL ACRES	TREATMENT	HARVEST METHOD	HARVEST VOLUME (MBF)	SITE PREPARATION	REGENERATION METHOD AND SPECIES (*and/or)
2	10.2	Moderate Reserve	Tractor	117.5	Machine Pile & Scarification	Plant: PP
3	190.8	Heavy Reserve	Tractor & Cable	2687.6	Machine Pile & Scarification	Natural or Plant: WL * WP
5	45.6	Heavy Reserve	Soft Track	627.0	Machine Pile & Scarification	Natural or Plant: WL * WP
10	7.8	Light Reserve	Tractor	68.1	Machine Pile & Scarification	Plant: PP
Totals	254.4			3500.2		

PP=Ponderosa Pine WL=Western Larch WP=White Pine

Figure 2.5 South Fork Lost Creek Alternative E



III. SILVICULTURAL TREATMENTS

The timber-harvest alternatives employ combinations of three different silvicultural treatments. The treatments proposed for the South Fork Lost Creek project have been designed to emulate the historical effects of natural fires and are intended to promote natural levels of structural and compositional diversity.

A. LIGHT-RESERVE, REGENERATION HARVEST

1. Harvesting

Light-reserve, regeneration harvesting emulates many of the effects of a high-intensity, stand-replacing fire. Such a fire would greatly alter the structure and composition of overstory and understory vegetation. Light-reserve treatment would remove most of the overstory and understory vegetation within cutting units. Hiding and thermal cover would not be retained; however, the following important stand components would be reserved when available:

a) Approximately two large trees per acre with an average diameter of about 22 inches. Preferred reserve trees include western larch (*Larix occidentalis*), Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*)—all of which have a high resistance to fire and wind. Western red cedar (*Thuja plicata*), although not as resistant to fire and wind as western larch, Douglas-fir and ponderosa pine, is also a preferred reserve tree. Reserve trees would provide for some structural diversity and future snag recruitment. They would have intact crowns and represent the healthiest trees available, but might not always meet seed tree quality. Reserved trees should not be likely to spread disease. On slopes greater than 50 percent, some reserve trees might be damaged by broadcast burning of logging slash. If this were to occur, these trees would not be salvage harvested.

b) Small, scattered clumps of healthy, residual understory focusing on the retention of shade-intolerant species.

c) Approximately two live trees with broken boles per acre, that would not be likely to spread disease.

d) All dead standing trees (snags) that do not qualify as hazards under regulations of the Office of Safety and Health Administration (OSHA).

e) Fifteen to twenty tons per acre of large, down, woody material. At Least 50% of the down woody material would be 16 feet or longer.

Retention of stand components would depend on their presence, health, and vigor. Stand components would be reserved in various, naturally-occurring shapes and sizes. The residual stand would average 10 square feet in basal area per acre and have approximately 11 percent crown cover.

2. Slash disposal and site preparation

Slash disposal to reduce the fire hazard and prepare the site for regeneration would be accomplished by using one or a combination of the following methods. On slopes less than 50 percent, excavator-piling and hand burning of slash would be the preferred method of slash disposal. On slopes greater than 50 percent, broadcast burning would be preferred. Both methods might be used on units where some slopes are greater than 55 percent and some less. Restricted access to portions of units with slopes less than 55 percent could preclude the use of machines to pile slash. Broadcast burning would be considered for these areas.

Broadcast burning would be accomplished by hand burning or with a helitorch. Whole tree yarding would only be considered on units that do not lend themselves to excavator-piling or broadcast burning and that exceed the tons per acre requirements of the hazard reduction agreement.

a) **Site preparation for regeneration on slopes less than 55 percent**

Mineral soil would be exposed on 30 to 40 percent of the site. Scarification would be accomplished with an excavator-piler. The soil would be scarified over the entire site in randomly-spaced patches varying in size.

b) **Site preparation for regeneration on slopes greater than 55 percent**

The duff layer would be reduced over 20 to 30 percent of the site. Site preparation would be accomplished by broadcast burning. Slash would be cleared from around the bases of reserve trees to help prevent scorching and damage to the trees.

3. Regeneration

Prepared sites would favor the establishment of shade-intolerant species. The establishment of shade-intolerant species would contribute to structural and compositional diversity by promoting the long-term presence of many species with varying degrees of shade tolerance.

Regeneration would establish primarily from adjacent stands. Natural regeneration would be supplemented by interplanting western white pine (*Pinus monticola*) that is resistant to white pine blister rust. Interplanting healthy, rust-resistant western white pine would promote its continued presence in the project area. Western larch, ponderosa pine and lodgepole pine also are viable species that would be considered for interplanting to supplement natural regeneration.

B. MODERATE-RESERVE, REGENERATION HARVEST

1. Harvesting

Moderate-reserve, regeneration harvesting emulates the effects of either a moderate-intensity, stand-replacing fire, or a hot, mixed severity fire. Either type of fire would greatly alter the structure and composition of both overstory and understory vegetation. Moderate-reserve treatment would remove most overstory and understory vegetation within cutting units. Hiding and thermal cover would not be retained, but the following important stand components would be reserved when available:

a) Approximately six large (at least 20 inches dbh), healthy, seed trees with straight boles and good crown development per acre. Preferred reserve tree species would include western larch, Douglas-fir, ponderosa pine and western red cedar. Depending on availability, reserved trees would be scattered at random or reserved in groups. On slopes greater than 55 percent, some of the reserve trees might be damaged by broadcast burning of logging slash. If this were to occur, these trees would not be salvage harvested.

b) Small, scattered clumps of healthy understory focusing on the retention of shade-tolerant species.

c) Approximately two live trees with broken boles per acre that would not be likely to spread disease.

d) All dead standing trees (snags) that do not qualify as hazards under OSHA regulations.

e) Fifteen to twenty tons per acre of large, down, woody material. At least 50% of the down woody material would be 16 feet or longer.

As with light-reserve treatment, the retention of these stand components would depend on their presence, health, and vigor. Stand components would be reserved in various, naturally-occurring shapes and sizes. The residual stand remaining after moderate-reserve treatment would average 21 square feet of basal area and have approximately 18 percent crown cover.

2. **Slash disposal and site preparation for regeneration**

Slash disposal to reduce the fire hazard and prepare the site for regeneration would be accomplished with one or a combination of the following methods. On slopes less than 55 percent, excavator-piling and hand burning of slash would be preferred. On slopes greater than 55 percent, broadcast burning would be preferred. Both of these methods may be used on units where some slopes are greater than 50 percent and some less. Restricted access to portions of units with slopes less than 50 percent could preclude the use of machines to pile slash. Broadcast burning would be considered for these areas.

Broadcast burning would be accomplished by hand burning or with a helitorch. Whole-tree yarding would be considered only on units that do not lend themselves to excavator-piling or broadcast burning and that exceed the tons per acre requirements of the hazard reduction agreement.

a) **Site preparation for regeneration on slopes less than 50 percent**

Mineral soil would be exposed on 30 to 40 percent of the site. Scarification would be accomplished with an excavator-piler. The soil would be scarified over the entire site in randomly-spaced patches varying in size.

b) **Site preparation for regeneration on slopes greater than 50 percent**

The duff layer would be reduced over 20 to 30 percent of the site. Site preparation would be accomplished by broadcast burning. Slash would be cleared from around the bases of reserve trees to help prevent scorching and damage to the trees.

3. **Regeneration**

The prepared site would favor the establishment of shade-intolerant species. The establishment of shade-intolerant species would promote long-term structural and compositional diversity. Regeneration would establish by seed from reserve trees and adjacent stands. As with light-reserve treatment, natural regeneration would be supplemented by interplanting rust-resistant western white pine. Western larch, ponderosa pine and lodgepole pine also are viable species that would be considered for interplanting to supplement natural regeneration.

C. *HEAVY-RESERVE, REGENERATION HARVEST*

1. **Harvesting**

Heavy-reserve regeneration harvesting emulates the effects of a ground fire with varying intensity. Such a fire would alter stand density and species composition of overstory and understory vegetation. Heavy-reserve treatment would remove 20 to 70 percent of the overstory trees in a cutting unit, depending on the stand density. Currently the basal area of mature stands in the project area ranges from 100 to 300 square feet per acre; heavy-reserve treatment would reduce basal area to approximately 80 square feet. Trees would be removed singly, in groups, or in strips not larger than 0.5 acre. The largest diameter shade-intolerant species would be favored for retention, but some of all existing species would be reserved. Live trees with broken boles and dead standing trees that do not qualify as hazards under OSHA regulations would be reserved. Fifteen to twenty tons of large, down, woody material also would be reserved. A minimum of 50% of the down woody material would be at least 16 feet long.

2. **Slash disposal and preparation of sites for regeneration**

   Slash disposal on slopes less than 55 percent would be accomplished by excavator-piling and hand-burning. Slash disposal on slopes greater than 55 percent would be accomplished by either broadcast burning or lopping and scattering.

   To prepare the site for regeneration, mineral soil would be exposed on 20 to 30 percent of the site. Scarification would be accomplished with the excavator-piler. Where patches, groups, or stringers of trees were removed, the soil would be scarified in randomly-spaced patches varying in size.

3. **Regeneration**

   The prepared site would promote establishment of both shade-tolerant and shade-intolerant species thus promoting long-term structural and compositional diversity. Regeneration would establish by seed from the residual overstory. Natural regeneration could be supplemented by interplanting western larch, ponderosa pine, lodgepole pine and rust-resistant western white pine.

IV. SUMMARY OF ENVIRONMENTAL EFFECTS

Table 2.5 summarizes the environmental consequences of the alternatives. The scientific basis for the environmental effects summarized here is discussed in more detail in Chapter 4. Refer to Chapter 4 for a complete understanding of the terms, quantities, and statements presented here.

Table 2.5 Summary of Environmental Effects

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
Forest Conditions					
1. Cover Type * Representation	Continued shift to shade-tolerant species; movement away from appropriate conditions	Increase shade-intolerant species by 236 acres; movement toward appropriate conditions	Increase shade-intolerant species by 309 acres; movement toward appropriate conditions	Increase shade-intolerant species by 142 acres; movement toward appropriate conditions	Increase shade-intolerant species by 14 acres; movement toward appropriate conditions
2. Age Class Distribution and Old Growth in Project Area	Overall increase in old growth over time; movement away from appropriate conditions	Old growth reduced by 130 acres; movement toward appropriate conditions	Old growth reduced by 103 acres; movement toward appropriate conditions	Old growth reduced by 200 acres; movement toward appropriate conditions	Old growth reduced by 4 acres; movement toward appropriate conditions
3. Old Growth Attributes					
3a. Structure	Over time, increase in uneven-age condition	Increase proportion of single-story old growth stands	Increase proportion of single-story old growth stands	Increase proportion of single-story old-growth stands	Negligible effect on old-growth stands
3b. Vigor	Over time, increase number of old-growth stands with poor vigor	Increase amount of old-growth stands at full vigor.	Increase amount of old-growth stands at full vigor.	Increase amount of old-growth stands at full vigor.	Decrease amount of old growth in poor vigor class
3c. Large Trees	Over time, the proportion of large trees will be reduced.	Reduces the proportion of old-growth stands with 'lots' of old trees.	Reduces the proportion of old-growth stands with 'lots' of old trees.	Reduces the proportion of old-growth stands with 'lots' of old trees.	Reduces the proportion of old-growth stands with 'lots' of old trees.
3d. Snags	In the short term, the amount of snags will increase; in the long term, large snags will decrease.	Reduces the proportion of old-growth stands with 'lots' of snags.	Reduces the proportion of old-growth stands with 'lots' of snags.	Reduces the proportion of old-growth stands with 'lots' of snags.	Reduces the proportion of old-growth stands with 'lots' of snags.
3e. Coarse Woody Debris	Over time, the amount of coarse woody debris will increase	Reduces the proportion of old-growth stands with 'lots' of coarse woody debris.	Reduces the proportion of old-growth stands with 'lots' of coarse woody debris.	Reduces the proportion of old-growth stands with 'lots' of coarse woody debris.	Slightly reduces the proportion of old-growth stands with 'lots' of coarse woody debris.

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
3f. Volume	Over time, gross volume in old-growth stands would increase.	Increases the proportion of volume in lower volume classes in old-growth stands.	Increases the proportion of volume in lower volume classes in old-growth stands.	Increases the proportion of volume in lower volume classes in old-growth stands.	Increases the proportion of volume in lower volume classes in old-growth stands.
4. Replacement Old Growth	No development of replacement old stands	Harvests less than 18 acres of replacement age stands.	Harvests less than 18 acres of replacement age stands.	Harvests less than 18 acres of replacement age stands.	Harvests less than 18 acres of replacement age stands.
5. Stand Vigor	Shade-intolerant species crowded out; reduction in vigor over time. Vigor rating 2.69	390 acres raised to full vigor; 133 acres would inprove one vigor class. Vigor rating 2.46	456 acres raised to full vigor; 151 acres would improve one vigor class. Vigor rating 2.46	266 acres raised to full vigor; 248 acres would improve one vigor class. Vigor rating 2.49	18 acres raised to full vigor; 236 acres would improve one vigor class. Vigor rating 2.62
6. Patch Sizes by Cover Type in project area	Decreases below current patch size over time	Large decrease in patch sizes in mixed conifer types	Large decrease in patch sizes in mixed conifer types	Large decrease in patch sizes in subalpine fir types	Large decrease in patch sizes in subalpine fir types
7. Patch Sizes by Age Class in the project area	Increase in old-growth patch size over time	Decrease in average patch size of old growth stands by 55 acres	Decrease in average patch size of old growth stands by 10 acres	Decrease in average patch size of old growth stands by 25 acres	Old-growth patch size is unchanged
8. Patch Shape** by Cover Type in project area	Reduction in complexity of patch shape	Reduction in complexity of patch shape	Reduction in complexity of patch shape	Reduction in complexity of patch shape	Reduction in complexity of patch shape
9. Patch Shape** by Age Class in project area	Decrease in patch shape	No effect on complexity of patch shape	No effect on complexity of patch shape	Increase in complexity of patch shape	Increase in complexity of patch shape
T&E Species (Grizzly Bear)					
1. Open Roads (% entire subunit >1.0 mi/mi^2)	28%	25%	25%	25%	25%
2. Open Roads (% DNRC acres >1.0 mi/mi^2)	35%	32%	32%	32%	32%

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
3. Total Roads (% entire subunit >2.0 mi/mi^2)	31%	31%	31%	31%	30%
4. Total Roads (% DNRC acres >2.0 mi/mi^2)	41%	42%	42%	41%	41%
5. Core Area) (entire subunit post harvest)	38%	39%	39%	40%	40%
6. Core Area (DNRC acres post harvest)	26%	26%	26%	29%	29%
7. Hiding Cover (entire subunit post harvest)	79%	79%	79%	79%	79%
8. Hiding Cover (DNRC acres post harvest)	80%	77%	77%	77%	79%
Big Game (Elk and Mule Deer)					
1. Habitat Effectiveness	75%	68%	70%	70%	71%
2. Thermal Cover (% of winter range, DNRC acres)	47%	39%	47%	36%	39%
3. Elk Security Cover (DNRC acres)	36%	30%	31%	30%	34%

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
Aesthetics					
1. General landscape characteristics *** (Variety = landscapes which are object-rich; Contrast = the degree to which objects are distinguished form one another; Texture = distinctive or identifying feature of the landscape depending on distance	Change would continue due to natural processes. Character of landscape would remain the same.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture, with subtle changes to variety and contrast.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture, with subtle changes to variety and contrast.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatmcnt would change texture, with subtle changes to variety and contrast.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture, with subtle changes to variety and contrast.
Watershed					
1. Annual runoff South Fork Lost Creek Watershed	1% increase over natural runoff. (10% allowable. increase)	3% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10 % allowable increase)	2% increase over natural runoff. (10 % allowable increase)
2. Number of cutting units located within a SMZ.	None	None	None	None	None
3. Existing Sources of Sediment that would be mitigated.	Erosion sources not mitigated.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.	7.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, removal of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
Air Quality					
	No change to existing air quality.	Burning on 523 acres: Temporary reduction in air quality.	Burning on 607 acres: Temporary reduction in air quality.	Burning on 514 acres: Temporary reduction in air quality.	Burning on 254 acres: Temporary reduction in air quality.
Soils					
1. Soil Erosion Potential from Road System	Erosion potential may increase on existing road system.	Decrease erosion potential by implementing mitigation.	Decrease erosion potential by implementing mitigation.	Decrease erosion potential by implementing mitigation.	Decrease erosion potential by implementing mitigation.
2. Soil Impacts: Displacement and Compaction	No change in existing compaction of the area in old skid trails and landings.	Mitigation would limit impacts to about 6% of the harvested acres. Approximately 33 acres would be affected	Mitigation would limit impacts to about 4% of the harvested acres. Approximately 26 acres would be affected	Mitigation would limit impacts to about 7% of the harvested acres. Approximately 36 acres would be affected	Mitigation would limit impacts to about 9% of the harvested acres. Approximately 22 acres would be affected
Sensitive Species					
1. Black-backed Woodpecker	Probability of creation of habitat would remain stable or increase with time, and acreage of potential future habitat would not change	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 523 acres	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 607 acres	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 514 acres	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 254 acres
2. Townsend Big-eared Bat	No change in communal or individual roost site availability	No change in communal roost site availability. Some decrease in availability of individual roost sites	No change in communal roost site availability. Some decrease in availability of individual roost sites	No change in communal roost site availability. Some decrease in availability of individual roost sites	No change in communal roost site availability. Some decrease in availability of individual roost sites

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
3. Boreal Owls	No harvest would occur in boreal owl habitat; 19% of the project area would remain as boreal owl habitat	Harvest would occur on 221 acres of boreal owl habitat; 14% of the project area would remain as boreal owl habitat	Harvest would occur on 276 acres of boreal owl habitat; 13% of the project area would remain as boreal owl habitat	Harvest would occur on 131 acres of boreal owl habitat; 16% of the project area would remain as boreal owl habitat	Harvest would occur on 20 acres of boreal owl habitat; 19% of the project area would remain as boreal owl habitat
4. Fisher	No harvest would occur in preferred fisher habitat. Travel cover would remain available over most of the project area.	No harvest would take place in preferred riparian habitat. Travel cover would be reduced by 393 acres.	No harvest would take place in preferred riparian habitat. Travel cover would be reduced by 477 acres.	No harvest would take place in preferred riparian habitat. Travel cover would be reduced by 503 acres.	No harvest would take place in preferred riparian habitat. Travel cover would be reduced by 248 acres.
5. Lynx	No immediate changes in availability of foraging habitat; Project area in travel cover - 43%; Availability of denning habitat within project area- 22%.	No immediate changes in availability of foraging habitat, but will improve with successful regeneration; Project area in travel cover- 35%; Availability of denning habitat within project area- 20%.	No immediate changes in availability of foraging habitat, but will improve with successful regeneration; Project area in travel cover- 33%; Availability of denning habitat within project area- 20%.	No immediate changes in availability of foraging habitat, but will improve with successful regeneration; Project area in travel cover- 35%; Availability of denning habitat within project area- 17%.	No immediate changes in availability of foraging habitat, but will improve with successful regeneration; Project area in travel cover- 37%; Availability of denning habitat within project area- 21%.
6. Pileated Woodpeckers	No harvest would take place in Pileated habitat. No effects to the habitat.	Potential Pileated habitat would be reduced by 493 acres.	Potential Pileated habitat would be reduced by 475 acres.	Potential Pileated habitat would be reduced by 493 acres.	Potential Pileated habitat would be reduced by 239 acres.

RESOURCE	ALTERNATIVES				
	A	B	C	D	E
Economics					
1. Estimated Total Harvest Volume (MBF)	0.00	9,194	10,900	8,300	3,500
2. Estimated Stumpage Value ($/MBF)	0.00	$74	$49	$86	$60
3. Total $ Value – (Estimated Stumpage Value, FI cost and Development Cost times estimated harvest volume)	0.00	$1,447,228	$1,410,569	$1,422,703	$655,935
4. Total $ Revenue to the State (Estimated Stumpage Value + FI cost times estimated harvest volume)	0.00	$1,107,050	$1,039,969	$1,099,003	$372,435
5. Total $ Return to the Trust	0.00	$680,356	$534,100	$713,800	$210,000

*Indications of increased acreage refer to conditions after harvest and regeneration, either natural or by planting, or both.
**Numbers indicating patch shape refer to an index developed by McGarigal and Marks (1994). The lowest number, 1, refers to a perfectly square patch.
***As noted in the text, harvest units generally will be out of view of the public, or visible only at a distance.

V. PREFERRED ALTERNATIVE

The South Fork Lost Creek Supplement Environmental Impact Statement (SEIS) includes alternatives modified from those described in the Final Environmental Impact Statement (FEIS). These modifications contribute to some changes in the effects of the alternatives and to the comparison of effects between alternatives. It also includes an additional alternative that contributes to a broader range of alternatives being considered and to a broader range of effects between alternatives.

Alternative D has again been selected as the preferred alternative, although modification of alternatives in the SEIS contributed to reducing differences in effects between alternatives. The advantages of Alternative D over other alternatives is based primarily on Alternative D best meeting the project objectives. Changes in impacts to resources are relatively small.

A. PROJECT OBJECTIVES

The objectives of the South Fork Lost Creek Project have not changed from the FEIS, even though the range of alternative ways to meet those objectives has been expanded. Achieving the largest monetary return to the school trust in both the short term and long term remain of importance in identifying a preferred alternative.

The highest, short-term revenue return to the School Trust would continue to result from the modified Alternative D and would generate approximately $713,800. Alternative B would generate approximately $680,356 or 4.7 % less than Alternative D. Even though the margin of error in projecting monetary return may be greater than the difference between Alternative D and B, Alternative D appears to provide a slight advantage over Alternative B. Alternative C would generate 25 % less than Alternative D and Alternative E would generate 71 % less than Alternative D. Alternative C, and particularly Alterna-

tives A and E, do not contribute as effectively to short term return to the School Trust.

Stand vigor may contribute the most directly to maintaining and promoting monetary return to the School Trust through timber harvesting in the long term. Alternative D most effectively reduces the proportion of stands in the poor vigor class post harvest. Stands with poor vigor generally have mortality rates that exceed growth rates and therefore would lose potential revenue to the School Trust in the future. The reduction of stands in the poor vigor class, in Alternative D, may contribute most effectively to meeting the objective of providing for the largest monetary return to the School Trust in the long term.

B. HISTORICAL FOREST CONDITIONS

The alternatives vary widely in regard to moving existing forest conditions toward desired, future conditions. The desired future conditions are based on maintaining a distribution and proportion of ecological characteristics similar to average historical conditions. These appropriate conditions would contribute to maintaining a healthy, sustainable, biologically diverse forest and promote long term, potential, monetary return to the School Trust.

All of the timber harvest alternatives contribute to moving towards average historical conditions for most of the characteristics analyzed. Each of the alternatives vary in the amount of movement towards appropriate conditions and in the characteristics that are most influenced. None of the timber harvest alternatives provide a clear advantage on overall movement for most characteristics.

Alternative A, the no-action alternative would maintain the forest in a condition furthest from the desired future condition and would contribute to further departure from appropriate conditions in the long term. Alternative A would therefore contribute least effectively to both short-term and long-term monetary return to the trust.

C. OLD-GROWTH ATTRIBUTES

Timber harvesting in old-growth stands will substantially alter old-growth attributes within stands that are treated. These attributes include stand structure, stand vigor, large trees, snag numbers, coarse woody debris and gross volume per acre. The proportion and distribution of old-growth attributes within the project area will vary between alternatives. However, the more appropriate scale for evaluating old-growth attributes is the SRSF. At that scale harvest effects on old-growth attributes are negligible. The analysis of old-growth attributes, therefore, do not provide a clear basis for identifying a preferred alternative.

D. WILDLIFE EFFECTS

The analysis of effects on wildlife emphasize that a diversity of wildlife species also have a diversity of habitat needs. Any harvest treatment on any stand will have positive effects on some species while having negative effects on others. What may be more important than how individual species are affected at a stand level is that a diversity of habitat conditions is maintained in appropriate proportions and distributions across the SRSF. The Biological Diversity Guidelines contribute to maintaining appropriate proportions of stand conditions. Although each of the timber harvest alternatives moves the proportion of wildlife habitat characteristics toward appropriate conditions, none provide an overall advantage for most characteristics.

Each of the timber harvest alternatives were also developed around a SRSF old-growth network. The network contributes towards maintaining a distribution of large patches of old-growth and connectivity between patches of old growth to provide a functional old-growth network for wildlife (refer to project file).

Several factors contribute to minimizing differences in effects on wildlife habitat; 1)target stand conditions based on average historical stand conditions; 2) development of alternatives around an old-growth network; and 3) wildlife mitigations common to all timber harvest alternatives. These factors contribute to minimizing differences in

effects on wildlife between alternatives. The differences in effects on wildlife do not provide a clear basis for identifying a preferred alternative. As discussed above, Alternative A maintains and promotes forest conditions least similar to average historical conditions and is therefore least preferred.

E. SOILS

Although there are minor differences in effects on soils among alternatives, implementation of BMP's would minimize adverse effects to soil from any of the timber harvest alternatives.

F. WATERSHED

The harvest activities proposed in all timber harvest alternatives would fully comply with BMP's and the Montana SMZ law to minimize the risk of increased sedimentation from harvest units. Proposed restoration projects would lead to a net long-term benefit to water quality by stabilizing existing sources of sediment and improving surface drainage and potential for sediment delivery. Projections from the WATSED indicate water yield would increase from 1 % the existing increase over natural up to 3%. These temporary increases in water yield are minor considering the allowable increase over natural is at 10 %.

G. FISHERIES

Decreased acreages proposed for harvest and reduction of road construction in alternative D would lessen the potential impacts to fish spawning habitat, and enhance the benefits of the proposed rehabilitation sites.

H. AIR QUALITY

Direct and cumulative effects of proposed burning in timber harvest alternatives would not exceed limits defined by the Montana Cooperative Smoke Management Plan .

I. VISUAL QUALITY

Each of the timber harvest alternatives would have minor impacts on visual quality. It is not clear that overall, effects would be substantially different between harvest alternatives. Some alternatives would have a larger number of light reserve and moderate reserve harvest units. Other Alternatives have fewer but larger harvest units. Screening along roads would somewhat mitigate visual effects. The effects are acceptable in order to promote desired appropriate forest conditions.

J. RECREATION

Proposed timber harvesting would probably not eliminate any existing recreation opportunities.

CHAPTER 3
AFFECTED ENVIRONMENT

This chapter contains information on the environment in the Swan valley, the Swan River State Forest (SRSF), and the project area. The size of the analysis areas varies among resources depending on the requirements of the resource being analyzed and the methods used for the analysis. The cumulative effects of past activities are discussed in this chapter in terms of current conditions of resources.

I. PROJECT AREA

The project area comprises approximately 4,161 acres in the watershed of the South Fork of Lost Creek. Topography consists mainly of a steep narrow canyon with riparian areas along the streams, rocky outcrops and cliffs, avalanche chutes, heavily-timbered slopes and subalpine terrain. Elevations range from approximately 3,360 feet to 7,238 feet.

The project area is bordered on the north and south by high steep ridges that provide natural boundaries. These ridges run generally east-west, with their eastern ends in the alpine terrain at the eastern border of the watershed. The western border of the project area extends between the west ends of the ridges where the South Fork Lost Creek leaves the canyon between them and flows out onto the valley floor. The east border consists of the eastern boundary of the SRSF.

II. FOREST CONDITIONS

A. *BACKGROUND*

1. Landscape Analysis

The SFLMP directs DNRC to "take a coarse filter approach to biodiversity by favoring an appropriate mix of stand structures and compositions on state lands" (Montana DNRC ROD, 1996). To implement a coarse-filter approach and meet SFLMP directives, landscape-analysis techniques were used to determine an appropriate mix of stand structures and compositions, including cover-type representation, age-class distribution, structural characteristics, and spatial considerations, such as patch size, shape, and location. Structural attributes often associated with old-growth stands were also analyzed.

Landscape analysis is by its nature a hierarchical process. Different components of the landscape exist and interact at different scales. Relationships among landscape components also exist across varying scales. There is no single best scale where all components of a landscape can be analyzed.

While the SFLMP calls for a landscape analysis to be completed at the project level, some components of a landscape analysis, such as historical forest conditions and various spatial characteristics, are best examined at a broader scale.

At the very broad scale, Federal agencies have recently published a Draft EIS for the Interior Columbia River Basin Project (ICRBEMP 1997). Information from the Draft EIS can be used to describe how small-scale project analyses, such as that for the South Lost proposed project, fit into the regional picture of ecosystem condition.

In the following analysis, forest characteristics are examined at six scales: the stand, the project area, SRSF, The Climatic Section, western Montana, and the Interior Columbia River Basin (ICRB). The data are used to determine both historical conditions and project effects on forest characteristics in general, and old growth forests in particular.

2. Old-Growth Commitments from SFLMP

The SFLMP states that DNRC would "seek to maintain or restore old growth forest in amounts of at least half the average proportion that would be expected to occur with natural processes on similar sites" (MT DNRC 1996). Old growth must be retained not only in the amounts committed to, but in appropriate proportions and sites across the landscape. This makes it important to define the proportions of particular forest types that would be expected to develop within particular landscapes, rather than the much easier, but unsustainable, approach of managing simply for what is there now.

To assure that we are meeting our SFLMP commitments the DNRC has adopted a generic definition of old growth. We define old growth as:

> *Stands that are 150 years and older (140 years for lodgepole pine) that exhibit a range of structural attributes associated with old age, and contain a minimum of 4 mbf per acre net.*

Although the DNRC has chosen the above generic definition we recognize that when defining old-growth minimums for State forested lands, several complications must be addressed. A restrictive old-growth definition acceptable to all, or even most, resource professionals does not exist. The components important in one type of old growth may not be present or important in another type; thus, a restrictive definition of old growth for one forest type is unlikely to be applicable to another forest type. Finally, no quantification of a restrictively defined, naturally occurring amount of old-growth exists, and there is no realistic possibility of one ever being developed. The DNRC approaches the issue from the perspective that the characteristics of old growth stands that make them functionally different than other stands should be defined and managed for (see Indicators of Old-Growth Attributes).

Although no estimates of historic amounts of old growth are available, there are estimates of historic age-class distributions and accompanying estimates of proportions of old stands. This information is available from a forest inventory conducted in the 1930s across western Montana. Losensky (1997) summarized the 1930s inventories showing proportional age-class distributions by climatic section.

> *The proportion of old growth stands by cover type within a given analysis area, compared to the climatic section proportion of old stands from the 1930s' inventory, is DNRC's numeric criterion for assessing compliance with our commitment to retaining a minimum of 50% of old-growth amounts that would be expected to occur with natural processes on similar sites.*

DNRC must assess the SFLMP commitment based on old stands, but DNRC is not necessarily equating old stands with old growth, or suggesting that 'old growth attributes' would be ignored. Along with our generic old growth definition, DNRC will assess the structural attributes associated with old age that characterize the variety of old growth forest conditions that would have naturally occurred on the landscape. Old-growth stands that have high levels of 'old growth' attributes and stands that do not should both be included in DNRC's retention of old-growth stands, because DNRC is comparing current old-growth proportions to a historical assessment that included both types of stands. This degree of old growthness approach assures that we will be keeping all the pieces of both the ecosystem and old growth "pies" that could and should exist on the land we manage.

A key assumption is that retaining one half of old stands gives us the assurance we are keeping the range of conditions that should exist. We believe that both types of

old stands (i.e., old but not decadent, and old and decadent) are necessary to develop and retain the various characteristics of stands that may be important, but undefined.

Consequently, stands should be assessed as they come up for treatment on a project-by-project basis, keeping some with high 'old-growth' qualities while possibly harvesting others. Additionally, stands that are not technically old may possess many important 'old-growth' components serving the old-growth function better than some actual old stands, and, thus, should be considered as potential recruitment old stands.

The intent of the SFLMP is to maintain enough old growth to meet the specified old-growth commitment, but to not drop below that amount. The 'at-least-half' amount represents the minimum DNRC has committed to retaining, but does not necessarily represent the maximum desirable for retention.

B. *REGIONAL ASSESSMENT*

1. Interior Columbia River Basin (ICRB)

At the broad scale, assessments prepared for the 1997 ICRB Draft EIS (ICRBEMP 1997) are useful in examining how DNRC's small corner of the larger ecosystem fits into the bigger picture. The ICRB EIS reports on current ecosystem integrity and changes since the arrival of European-Americans. The effects of DNRC's activities at the project level would be negligible at the Basin scale. However, over time, human activities, such as fire suppression, timber harvesting, and building roads and cities, have had cumulative effects on the conditions of the forests across the entire basin.

Project actions must be considered within the broad scale and acknowledge that there may be positive or negative effects on broad-scale conditions, while still meeting DNRC's goals and objectives. DNRC's mandate is to generate revenue; the SFLMP clearly states the goal of managing for biodiversity and forest health on State forested trust lands, but not to make up for inappropriate conditions created by others on other ownerships (ROD 1996).

The information is useful for describing how State forests and project areas fit into the larger scheme of the landscape condition. General trends in forests across the ICRB show a decrease of ponderosa pine, western larch, and western white pine across their ranges. Primary transitions were to the more shade-tolerant species (true firs, hemlocks, spruces, and western red cedar). Fire regimes have increased in severity from predominantly mixed and lethal severities to a large predominance of lethal severity. Acres of old forests of both multistory and single-story structure also have decreased.

The ICRB EIS grouped forests into 3 broad categories:

Dry - includes ponderosa pine, dry Douglas-fir, and dry grand fir forests.

Moist - includes cedar/hemlock, moist Douglas-fir, grand fir, and wet spruce/fir forests.

Cold - includes the higher elevation forests not falling into 1 of the other 2 categories.

All 3 forest groups have experienced large increases in dominance by shade-tolerant species due to timber harvesting, fire suppression, insects, and diseases. Further, all 3 groups are much more likely to experience stand-replacement fires currently than they did historically. Increased density and canopy layering result in hotter burns with a greater likelihood of killing large overstory dominants and destroying duff layers and

shallow roots of species that generally would survive a fire disturbance under more natural conditions.

An overall decrease in old-growth stands has occurred in the dry forest group concomitant to a large increase in the multistoried condition and a large decrease in single-storied forests. Within the multistoried forests, shade-tolerant tree species are 3 times as abundant. Ponderosa pine has been replaced by grand fir or Douglas-fir on nearly 40% of its range. Currently, shade-tolerant species dominate 30% more stands than historically. There are also 25% more acres of young stands.

The moist forest group also has seen a large increase in density and dominance by shade-tolerant species. It has experienced decreases in early seral and old-growth stands. Old forests of shade-intolerant species (primarily ponderosa pine, western larch, and, in places, Douglas-fir) have decreased 86%, while old forest dominated by shade-tolerant species has doubled. Both shade-intolerant and shade-tolerant species in multistoried forests have decreased. Young forests of shade-tolerants are much denser and twice as common. Young forests of shade-intolerants are 33% less common than historically.

Cold forests have experienced less change due to elevation and slow growth. However, here, too, shade-tolerants (spruce, and subalpine fir) have increased at the expense of shade-intolerants, primarily whitebark pine and alpine larch. Additionally, blister rust has played a role in reducing the distribution of whitebark pine.

C. *HISTORICAL FOREST CONDITIONS*

Estimating historical conditions is important in defining what the forest looked like before widespread influences of the industrial age. The working assumption is that average historical conditions represent a healthy, sustainable, biodiverse forest with all the pieces intact, that is, an appropriate forest condition as committed to in the SFLMP. Historical conditions provide an indication of a desirable future condition for the forest, tempered necessarily, by current circumstances. In accordance with the Record of Decision (ROD-12), this desired future condition is referred to as the appropriate mix of stand structures and compositions on state lands. Appropriate conditions are based on ecological characteristics (e.g., land type, habitat type, disturbance regime, unique characteristics), and can be characterized by the proportion and distribution of forest types and structures historically present on the landscape.

1. Data Sources

The best inventory information available to approximate pre-industrial age forest conditions was prepared by Losensky (1997). Losensky summarizes a 1930 inventory completed for all forest lands in western Montana. The data that Losensky used for broader assessments include the original inventory of the Swan valley.

The 1930s inventory that Losensky summarized has been digitized at the scale of the SRSF and the South Lost project area and the data are carried as a layer in DNRC's Geographic Information System (GIS).

Other recent assessments of historic forest conditions in the general area of the SRSF have been made by the Flathead National Forest (USFS 1992, 1998), Hart (1994), and the analysis conducted by DNRC for the Middle Soup EIS (DNRC 1997) which also summarizes the other works mentioned above.

2. Cover Type Representation

The first step in determining appropriate forest conditions is to quantify historical cover type proportions on the landscape. Losensky (1997) provides historical amounts of cover types (including species composition relative to proportion of stand

board foot volume), corresponding age class distribution (determined from the same species and size class used for cover type), and proportion of old stands by cover type. The cover type age class data provide an essential component for determining average historical conditions. Table 3-1 describes the 1930s and the current cover types by proportional representation of species that comprise each cover type.

moister environment. Both western Montana and the Climatic Section are big enough to represent general trends and average conditions whereas the 39,000-acre SRSF is *too small*. Data from SRSF and the South Fork Lost Creek project area are useful for examining current trends in vegetative change brought about through succession, fire suppression, harvesting and other activities, but the

TABLE 3-1. COVER TYPE REPRESENTATION (1930S AND CURRENT). STANDS ARE EVALUATED SEQUENTIALLY AGAINST THE PROPORTIONS SHOWN AND ASSIGNED TO THE APPROPRIATE TYPE. ONCE ASSIGNED A STAND IS NOT SUBJECTED TO FURTHER CRITERIA

Cover Type	**Proportional Representation (%) of Species in each Cover Type**				
	PP	DF	WL	WP	LP
White pine (WP)				≥10	
Ponderosa pine (PP)	≥20				
Western larch (WL) Douglas-fir		DF + WL ≥70			
Douglas-fir (DF)		≥ 60			
Lodgepole pine (LP)					≥ 50
Mixed conifer (MC)	Habitat type <630 and stands not yet assigned				
Subalpine types (ST)	All remaining stands				

The historical data for proportions of cover types in all of western Montana, Climatic Section 333C, the SRSF, and the South Fork Lost Creek project area are summarized in Table 3-2. The Climatic Section is contained in western Montana and includes the entire Swan River State Forest. The Climatic Section (or the upper Flathead Valley) corresponds to the area between Flathead Lake and the Continental Divide and from the Canadian Boundary south to the Clearwater River - Swan River divide.

The data indicate that Climatic Section 333C is cooler and moister than is average for western Montana with higher proportions of lodgepole pine, mixed conifers, and subalpine types. The lower proportions of ponderosa pine and Douglas-fir also indicate a cooler and

small size of these areas prevents their use in determining long-term average conditions.

Table 3-2 shows that historic representation of shade-intolerant tree species (e.g., ponderosa pine, western larch, white pine, lodgepole pine and Douglas-fir) cover types averaged 67 percent for western Montana, 56 percent for the climatic section average, and 79 percent for SRSF. The South Fork Lost Creek project area, however, showed only 47%, and was dominated by shade-tolerant tree cover types (e.g., mixed conifer, subalpine fir) at 53 percent.

The mixed conifer type generally is made up of shade tolerant tree species. Occasionally, a particular shade tolerant species may dominate a stand. Regarding

the 1930s inventory of the SRSF, stands dominated by western red cedar comprised 123 acres in the southern portion of the SRSF. None of the stands in the South Lost project area were classified as cedar stands in the 1930s.

Some caution should be exercised when using the 1930s data. Spatial information relating to stand sizes and shapes may be especially problematic due to mapping difficulties given the lack of tools (e.g., topographic maps, roads, access, etc.) available at the time the data was collected. Exact location information of particular stands may also be somewhat inaccurate. To some degree, even cover type designations may be inaccurate in difficult to reach areas, and for narrow riparian stands. However, we present the data with these caveats to indicate what we believe to be the most accurate reflections available of reality in the 1930s.

3. Age Class Distributions

Age class distributions delineate another characteristic important for determining average historical or appropriate conditions. Knowledge about local topographic effects, ecological characteristics of tree species, climatic-vegetational relationships, and disturbance regimes adds clarity to the picture of appropriate conditions. The 1930s inventories also quantified the ages of forest stands. Losensky examined the data and projected the stands back in time to the early 1900s to arrive at age estimates. These data are useful in setting baseline conditions for determining the extent to which current forest age class distributions deviate from average historical conditions. Old stands from the 1930s data were described as those stands over 170 years of age for ponderosa pine, Douglas-fir, and western larch cover types, over 140 years for lodgepole pine, and over 180 years for

TABLE 3-2. THE HISTORICAL PROPORTION OF EACH COVER TYPE IN WESTERN MONTANA, CLIMATIC SECTION 333C (THE UPPER FLATHEAD VALLEY), SWAN RIVER STATE FOREST, AND THE PROJECT AREA.

Cover Type	Proportional Representation (%)*			
	Western Montana	Upper Flathead – Climatic Section 333C	Swan Forest	South Lost
Ponderosa Pine	21	1	3	2
Douglas-fir	8	<1	>1	5
Western larch / Douglas-fir	26	28	66	38
White pine	3	1	8	0
Lodgepole pine	20	27	5	0
Mixed conifer	3	6	8	27
Subalpine types	20	36	6	26
Other types	trace	trace	3	2

**Estimated from 1930s inventory data. The proportion of area is based on all forested lands; water and non-forest were not included. The western Montana and upper Flathead numbers were summarized by Losensky (1997). SRSF and South Fork Lost Creek numbers are from DNRC analysis of 1930s data. Other types includes non-forested.*

the other types. No qualities other than stand age and net volume went into the assessments of historical old stand proportions. Our generic old growth definition matches the 1930s definition, but not all old growth stands would exhibit old growth attributes other than age and volume (see discussion on Old Growth Commitments from the SFLMP).

Tables 3-3 through 3-6 show the historic age class structure by cover type for western Montana, the Climatic Section, the SRSF, and the South Fork Lost Creek project area. Overall, the data in Tables 3-3 and 3-4 show the decreasing proportions in successively older age classes typical of broad scale assessments. Anomalies do occur within a cover type, such as the white pine type for the Climatic Section, where data show only 1 percent of the acres are in the non-stocked to 40-year age class, while 28 percent are in the next older age class. These anomalies are due primarily to small sample size. Mostly though, the proportions fall within expected ranges given known disturbance regimes, competitive abilities of various species, and ecological requirements.

The proportions of mature and old stands in the Tables 3-3 and 3-4 indicate the cooler and moister conditions of the Climatic Section compared to all of western Montana. Development of this older age class structure suggests that fire frequency at the climatic section level is slightly longer and that many fires of less than stand replacement severity occurred allowing stands to maintain vertical structure and older trees after fires, although at considerably lower stocking or density. Additionally, the general effects of succession are shown in the low proportions of younger age classes of shade-tolerant tree species.

Historical data compiled for the SRSF from the 1930s inventory are shown in Table 3-5, with Table 3-6 showing data from the same source for the South Fork Lost Creek project area. These tables show the irregular age class distributions typical of smaller scale assessments. Such distributions reflect an area heavily influenced by individual disturbance events (for the lodgepole type), or the lack of disturbance (for the other types).

Comparing Tables 3-3 and 3-4 to Table 3-5 shows that in the 1930s the SRSF was more heavily weighted to older age classes than would be expected with long term average conditions, as represented by the western Montana and climatic

TABLE 3-3. HISTORICAL AGE CLASS STRUCTURE BY COVER TYPE FOR ALL OF WESTERN MONTANA. PROPORTIONS (%) ARE BASED ON ACRES WITHIN EACH COVER TYPE.

Cover Type[1]	Non-stocked	1-40 years	41-100 years	101 years - Old Stands	Old Stands[2]
Ponderosa Pine	8%	10	11	16	55
Douglas-fir	5	23	33	34	7
Western larch / Douglas-fir	18	19	13	19	31
White pine	23	23	11	22	21
Lodgepole pine	18	39	31	9	3
Mixed conifer	6	11	19	20	43
AVERAGE[3]	15%	24%	20%	18%	23%

[1] *The subalpine type ages were not summarized in Losensky's report because they were inconsistently reported; some areas had them, others did not.*

[2] *Stands were considered old if they were over 170 years for ponderosa pine, Douglas-fir, and western larch/Douglas fir, 180 years for white pine and mixed conifer, and 140 years for lodgepole pine.*

[3] *The average represents the average age-class structure across all cover types. Non-forest land is not included.*

TABLE 3-4. HISTORICAL AGE CLASS STRUCTURE FOR EACH COVER TYPE IN CLIMATIC SECTION 333C (UPPER FLATHEAD VALLEY). NON-FOREST LAND IS NOT INCLUDED.

Cover Type[1]	Non-stocked	1-40 years	41-100years	101 years-Old Stands	Old Stands[2]
Ponderosa Pine	2%	11	6	7	74
Douglas-fir	2	24	39	29	6
Western larch / Douglas-fir	10	13	10	20	47
White pine	0	1	28	54	17
Lodgepole pine	21	38	29	7	5
Mixed conifer	2	4	9	42	43
AVERAGE	14%	22%	13%	22%	29%

[1] *The subalpine type was not assigned an age in the 1930s inventory.*
[2] *Stands were considered old if they were over 170 years for ponderosa pine, Douglas-fir, and western larch/Douglas-fir, 180 years for white pine and mixed conifer, and 140 years for lodgepole pine.*

TABLE 3-5. 1930S INVENTORY DATA FOR PROPORTIONAL AGE CLASS STRUCTURE BY COVER TYPE FOR THE SRSF, AND TOTAL ACRES BY COVER TYPE. THE AVERAGE REPRESENTS THE AVERAGE AGE CLASS STRUCTURE ACROSS ALL COVER TYPES.

Cover Type	No Age	0-39 years	40-99 years	100 years - Old Stands	Old Stands[2]	ACRES
Ponderosa Pine		0%	0	0	100	1,019
Douglas-fir	100	0	0	0	0	219
Western larch / Douglas-fir		12	7	0	81	26,253
White pine		0	0	0	100	3,159
Lodgepole pine		36	64	0	0	1,801
Mixed conifer	5	0	18	2	74	1,345
Subalpine types	31	0	1	21	47	4,588
AVERAGE	5%	10%	8%	3%	74%	38,668 acres

[1] *The no age category represents land that was not typed as to age in the 1930s inventory.*
[2] *Stands were considered old if they were over 170 years for ponderosa pine, Douglas-fir, and western larch/Douglas-fir, 180 years for white pine, subalpine and mixed conifer, and 140 years for lodgepole pine.*

section averages. The data show the proportion of old stands as 2.5 times that contained in the entire Climatic Section and over three times the proportion for all of western Montana. Correspondingly, younger age classes were substantially under represented. In particular the under-40 and non-stocked categories totaled 9 percent of the SRSF in 1930, in contrast to 36 percent of the Climatic Section.

The 1930s inventory of the SRSF shows a forest that has been relatively free from disturbance for a considerable time. SRSF's 74 percent in old stands contrasts to broader scale quantifications made by several other researchers. Losensky's (1997) data for the broader Climatic Section showed only 29 percent old stands. The Flathead National Forest (USFS 1992) concluded that at the turn of the century, in the Swan valley, "About 40 percent of the area was occupied by mature and older forests." The Flathead National Forest (USFS 1998) concluded that a historic range of variability in old growth forests on the FNF was approximately 15 to 60%; the variation has been strongly controlled by the frequency and severity of fire. Lesica (1996) suggested through mathematical modeling that 34.5 percent of forests with a mean fire return interval of 150 years (roughly equivalent to much of the Swan valley) would be in age classes of 160 years and older.

Table 3-6 shows the 1930s inventory age class and cover type distributions within the South Fork Lost Creek project. The non-stocked acres number in the subalpine cover type refers to non-commercial acres, as so deemed in the 1930s. These are not included in the overall proportions of the various age classes. An older forest is present in the South Fork Lost Creek area than in the SRSF in general with a much higher proportion of shade-tolerant species cover types. The type and age characteristics reflect the long absence of disturbance and the effects of forest succession.

5. Habitat type Groups

Habitat type groups define areas of similar temperature and moisture regimes capable of supporting particular vegetative associations. HTGs are also a primary indicator of fire groups, which classify prevailing severities and frequencies of fire. Representation of habitat type groups (HTG) for the entire SRSF and the South

TABLE 3-6. 1930S DATA FOR PROPORTIONAL AGE CLASS DISTRIBUTION BY COVER TYPE AND ACRES OF COVER TYPE WITHIN THE SOUTH FORK LOST CREEK PROJECT AREA. THE AVERAGE REPRESENTS THE AVERAGE AGE CLASS STRUCTURE ACROSS ALL COVER TYPES.

Cover Type	No Age	0-39 years	40-99 years	100 years - Old Stands	Old Stands	ACRES
Ponderosa Pine	0%	0	0	0	100	81
Douglas-fir	100	0	0	0	0	219
Western larch/Douglas-fir	2	10	11	0	78	1,586
White pine	0	0	0	0	100	16
Lodgepole pine	0	65	35	0	0	18
Mixed conifer	0	0	0	0	100	1,145
Subalpine types	78[1]	0	0	2	100	1,066
AVERAGE[2]	27%[1]	6%	2%	1%	65%	4,162 acres

[1] *The no age category represents land that was not categorized by age in the 1930s inventory. The no age numbers in the subalpine cover type refer to non-commercial land (as deemed in the 1930s), which was not categorized by age. Non-commercial land is not included in the overall proportions of the various age classes.*

[2] *Water, hardwoods, and non-forest categories have been removed.*

Fork Lost Creek project area is shown in Table 3-7. As the table shows, the SRSF is slightly warmer than the South Fork Lost Creek project area with higher representation of warm habitat type groups and lower proportional representation of cool habitat type groups. The differences are not substantial with both areas being dominated by moist groups and in particular the warm moist group.

6. Structural Characteristics

Historical structural characteristics were not defined beyond the same classes used to describe age class distributions. The structural categories defined for the various age classes were as follows: ages 1 to 40 - seedling to sapling; 41 to 100 - poles; 101 to old stands - mature; and 170 or 180 and over - old stands. These categories may or may not be meaningful due to the strict adherence to stand age used for their assignment.

7. Patch Characteristics

The SRSF and the project area are the only scales analyzed for which historic quantification of patch size and shape information is available. 1930s patch size and patch shape indices by cover type are shown in Table 3-8. The western larch / Douglas-fir patch size quantification is dominated by a single patch over 14,000 acres, much of which occurred within the South Lost project area.

Historic patch sizes and shapes for different age classes are shown in Table 3-9. Note the large patch sizes of old growth stands. Overall, age class patch sizes do not differ greatly from cover type patch sizes. Patch shape is simpler for the SRSF than the project area. Patch shape information is useful in comparing patches within the same landscape over time. The 1930s inventory used a minimum mapping unit size of 40 acres. Our SLI uses a minimum size of 5 acres. Thus, many stands we would delineate would be absorbed by larger adjacent stands in the 1930s maps decreasing numbers of patches and increasing patch size.

8. Forest Fire History in the Swan Valley

Fire has been a major influence on the characteristics of forested landscapes in the Swan valley, as in most forests of western Montana. The severity, frequency, and area covered by fires varies, depending on micro-site conditions, from infrequent, stand-replacing burns, through intermediate frequency, intermediate intensity burns, to frequent, thinning underburns. The latter type appears to have been restricted to the upper

*TABLE 3-7. HABITAT TYPE GROUP REPRESENTATION ON SRSF AND THE SOUTH LOST PROJECT AREA.**

Habitat Type Group	Acres		Proportion of Area (%)	
	SRSF	South Fork Lost Creek	SRSF	South Fork Lost Creek
Moderately warm/dry	1,571	0	4	0
Moderately cool/dry	251	0	<1	0
Warm and moist	24,480	2,144	63	53
Cool and moist	10,062	1,884	26	47
Wet	1,190	0	3	0
Moderately cool/moist	190	0	<1	0
Cool and moderately dry	614	1	2	>1
Cold and moderately dry	69	0	<1	0

**Habitat type grouping follows Green et al. 1992.*

TABLE 3-8. PATCH SIZE AND SHAPE INDEX BY COVER TYPE FROM THE 1930S INVENTORY ON THE SRSF. PATCH SIZE IS EXPRESSED IN ACRES FOR PATCHES OF EQUIVALENT COVER TYPE. PATCH SHAPE WAS DERIVED WITH THE PATCH SHAPE INDEX OF MCGARIGAL AND MARKS (1994).*

Patch Size	number of patches	Total	Minimum	Mean	Median	Max	Standard Deviation
Subalpine	11	2,595.4	20.8	235.9	134.8	1,094.2	329.5
Douglas-fir	1	215.8	215.8	215.8	215.8	215.8	N/A
Hardwood	7	275.7	6.0	39.4	21.0	107.2	45.6
Lodgepole Pine	16	1,796.5	8.6	112.3	70.0	362.6	113.1
Mixed Conifer	32	3,321.1	5.7	103.8	53.7	1,145.0	203.0
Ponderosa Pine	5	1,016.2	31.5	203.2	128.2	442.8	176.1
Western Larch/ Douglas-fir	31	26,240.1	5.4	846.5	278.9	14,564.1	2,609.9
White Pine	13	3,147.5	5.1	242.1	124.6	1,146.4	327.3
Non-forested	26	1,195.7	5.6	46.0	25.4	180.7	48.6
TOTAL	**192**	**39,888.5**	**5.1**	**280.3**	**70.4**	**14,564.1**	**1,253.9**

Patch Shape	Minimum	Mean	Median	Max	Standard Deviation
Subalpine	1.129	1.726	1.809	2.506	0.369
Douglas-fir	1.775	1.775	1.775	1.775	N/A
Hardwood	1.207	1.562	1.307	3.107	0.686
Lodgepole Pine	1.216	1.485	1.402	2.411	0.292
Mixed Conifer	1.048	1.434	1.403	2.514	0.328
Ponderosa Pine	1.111	1.360	1.359	1.781	0.271
Western Larch/ Douglas-fir	1.013	1.395	1.266	2.845	0.390
White Pine	1.035	1.662	1.562	2.573	0.530
OTHER	1.061	1.690	1.365	4.088	0.844
TOTAL	**1.013**	**1.528**	**1.391**	**4.088**	**0.514**

** The patch shape index of McGarigal and Marks (1994) calculates patch shape complexity. The calculation uses the perimeter and area of each patch, and corrects for the effects of patch size. A perfectly square patch takes a value of 1. Circular patches have a complexity value less than 1. More irregular shapes take numbers higher than 1.*

portion of the Swan River drainage, south of the SRSF.

Hart (1994:36) summarized the historical data as follows:

> Although most of the burns...were of stand-replacement intensity, many less intense fires had also crept over wide areas. The upper [i.e., southern] half of the Swan valley had been extensively burned, and was blanketed by fallen trees. In this area, fires were moderate, thinning the forest. The lower [i.e., northern] Swan also was scarred by fires, but it had a great deal of older mixed forest; species typical of mesic sites were found in this region....

Antos and Habeck (1981), working mostly in the northern portion of the Swan valley, emphasized the dominance of low-frequency, high-intensity fires (i.e., "stand-replacement fires") in determining stand patterns:

> During most summers, the occurrence of frequent rain makes intense fires unlikely; but in some years, dry summers set the stage for large crown fires. Most stands were initiated on large burns.... An average frequency of replacement burns of between 100 and 200 years was characteristic.... Stands over 300 years old do occur, and repeat burns less than 20 years apart have also occurred. In some forests initiated by replacement burns, ground fires have

TABLE 3-9. PATCH SIZE AND SHAPE INDEX BY AGE CLASS FROM THE 1930S INVENTORY ON THE SRSF. PATCH SIZE IS EXPRESSED IN ACRES FOR PATCHES OF EQUIVALENT AGE. PATCH SHAPE DERIVED FROM THE PATCH SHAPE INDEX OF MCGARIGAL AND MARKS (1994).*

Patch Size	number of patches	Total	Minimum	Mean	Median	Max	Standard Deviation
NONE	31	3,216.7	5.6	103.8	36.4	645.4	144.7
000-039	19	3,745.2	8.6	197.1	94.5	1,542.2	361.9
040-099	20	3,227.2	22.9	161.4	109.8	825.8	191.6
100-Old Growth	10	994.6	21.8	99.5	64.9	228.6	72.7
Old Growth	40	28,651.0	5.4	716.3	217.8	14,400.2	2,273.0
TOTAL	**120**	**39,888.5**	**5.4**	**332.0**	**91.0**	**14,400.2**	**1,341.7**

Patch Shape	Minimum	Mean	Median	Max	Standard Deviation
NONE	1.0646	1.5972	1.4374	3.0816	0.5492
000-039	1.0114	1.4134	1.3934	1.9446	0.2791
040-099	1.1063	1.4367	1.4242	1.8987	0.2207
100-Old Growth	1.2626	1.5301	1.4964	1.8594	0.1996
Old Growth	1.0116	1.4286	1.2698	3.1964	0.4352
TOTAL	**1.0114**	**1.4795**	**1.3952**	**3.1964**	**0.4079**

** The patch shape index of McGarigal and Marks (1994) calculates patch shape complexity. The calculation uses the perimeter and area of each patch, and corrects for the effects of patch size. A perfectly square patch takes a value of 1. Circular patches have a complexity value less than 1. More irregular shapes take numbers higher than 1.*

> occurred after stand establishment, with variable effects on the over story. Very wet sites such as stream bottoms and lower north slopes often experience partial burns when located within the perimeter of large replacement burns" (Antos and Habeck 1981:29).

Freedman and Habeck (1984), who worked primarily in drier forests south of the South Lost project area but as far north as Goat Creek in the SRSF, emphasized the role of more frequent burns in the southern portion of the Swan valley, while agreeing with Antos and Habeck (1981) that fire frequency decreased with latitude:

> ...wildfire was commonplace in the Swan Valley. Fire-scarred ponderosa pines, charcoal in the soil layers, and the occurrence of even-aged stands of lodgepole pine...attest to the past presence of fire; the relative scarcity of old growth climax forests provides further insight into the influence of historic fire (Freedman and Habeck 1984:24).

The fire history analysis indicates that the [lower elevation portions of the Swan valley] was burned frequently; in the drier southern half...the intervals were shorter than on the more moist northern part. Between 1758 and 1905 this portion of the range had fire-free intervals of about 30 years, and the presence of western larch and even-aged lodgepole pine suggests the fires were of higher intensity....The remaining samples are from the southern end [i.e. south of the South Lost project area], and these have a shorter interval of 17 years (Freedman and Habeck 1984: 27).

9. Fire History in South Fork Lost Creek Canyon

The following excerpt is from an ecological fire analysis report on the South Fork Lost Creek Drainage conducted by Stephen W. Barrett (1996). The analysis area mentioned in this report is the same as the project area.

> An early forest survey (Ayres 1900) and archival maps (on file, USDA Forest Service Region One, Missoula) provided an initial landscape-scale perspective on fire's historical role near the Seeley-Swan valley. Ayres (1900) observed much evidence of fire throughout the valley, and mentioned that fires were widespread in the area about 1850 and 1889. The archival maps also depict a number of large fires after the turn of the century, for example, in 1910, 1919, 1920, 1929, 1934, and 1936. Although the largest of these fires missed the Swan valley, at least 30,000 acres burned in the valley from 1910 to 1936, particularly on the west side. The archival map also shows that a fire in 1920 burned several hundred acres in the South Fork Lost Creek project area, otherwise much of the watershed is occupied by mid-to-old-age stands.
>
> Field sampling and data analysis (Arno and Sneck 1977, Barrett and Arno 1988) revealed the following patterns of long-term fire history in the sampling. These data were supplemented by stand exam data and aerial photographs (on file, Swan River State Forest), which produced a 5-century Master Fire Chronology and coarse-scale fire history map. The fire chronology, which spans from ca. 1460 to 1920, ends with the 1920 event because it was the last fire of any significance in the area. At least nine fires occurred during the 460-year period, yielding a mean fire interval (MFI) of about 58 years for the entire analysis area. Intervals between consecutive fires in the drainage ranged from 9 to 120 years, and the last substantial fire in the project area occurred in 1920 (data end with 1995 fire season).
>
> By comparison, post-1950 fire suppression records (on file, Swan River State Forest) indicate that, on average, a lightning fire has occurred every 3 to 4 years in the project area. If lightning ignition patterns were similar over the past 5 centuries, then only one out of about every 15 ignitions evolved into a major fire. Clearly, most lightning-caused fires either expired without spreading, or developed into small patchy surface fires that did not significantly alter stand structures. This analysis cannot account for possible influence from frequent Indian-caused fires in the drier forests of the main Swan valley bottom. However, inherently high fuel moisture during most fire seasons in these productive habitat types probably would inhibit the spread of such fires into the analysis area itself.
>
> Both the area MFI and the range of historical fire intervals in the drainage are useful for documenting how often canyons such as the South Fork Lost Creek drainage experienced major disturbance before fire exclusion began in this century. The number of years since the last spreading fire also can provide perspective on the influence of fire history and fire regime maps, allowing forest planners to infer the role of wildfire in changing landscapes over the past 5 centuries.
>
> The sampling and aerial photographs verified that stand replacement fires have been dominant in the analysis area and elsewhere along the steep Swan front (Ayres 1900, Antos 1977). A mixed severity fire regime has been relatively common in the main valley bottom, and in localized areas within the South Fork Lost Creek drainage.

10. Summary of Historic Forest Conditions

The historical data indicate that forests in the SRSF and South Fork Lost Creek project areas were cooler and moister than the broad scale Climatic Section

and western Montana averages. They were also considerably older with a far higher proportion of western larch/Douglas-fir cover types than at the broad scale. Although the forests of the SRSF were old, the representation of shade-tolerant tree cover types was low, indicating disturbance was frequent enough to prevent widespread cover type conversion through succession.

Forest patches tended to be large with relatively simple shapes. Old stands were particularly large averaging 716 acres in the SRSF. The western larch/Douglas-fir type covered more than 66 percent of the entire forest. White pine types were more common than would be expected from the Climatic Section average indicating a more maritime climatic influence. Mixed conifer and subalpine types together made up less than 15 percent of the forest.

Old western larch/Douglas-fir forests on the warm/moist HTG formed the matrix of the forest interspersed with patches of ponderosa pine on dry slopes, and patches of older white pine and mixed conifer stands. Moving up in elevation to the cool/moist HTG, western larch/Douglas-fir types again formed the matrix, but were interspersed with patches of subalpine and mixed conifer types.

D. CURRENT FOREST CONDITIONS

Not all the data used to describe historical conditions are available for current conditions and not all of the data on current conditions can be used to determine historic conditions. The data presented in this section represents that which is available rather than a selected set. Where possible, relationships between historical and current conditions are described using the most appropriate data sets for comparison. The information is presented in order from the largest scale to the smallest. The broad scale trends of decreased proportions of old growth, decreased shade-intolerant tree representation and corresponding increased shade-tolerant tree cover evident from the ICRB are also demonstrated at the SRSF level.

The procedures followed in the analysis below reflect those adopted by the DNRC through its Biodiversity Implementation Guidance. This consensus approach was developed with extensive internal review and comment. It also received outside professional review and comments. The Biodiversity Guidance was finalized by incorporating various comments received internally as well as externally.

CUMULATIVE EFFECTS

The analysis focuses on describing conditions across the entire SRSF as well as within the defined project area. Thus, it is a complete cumulative effects analysis as well, encompassing all previous activities on the forest. Consequently, no additional vegetation analyses labeled as cumulative effects are necessary. Subsequent projects will analyze vegetative condition forest wide as well.

1. Data Sources

DNRC assessed current conditions with a Stand Level Inventory (SLI) that covers the entire state ownership in SRSF. Sources of historical data are described in Chapter 3 II.C.1.

2. Past Management Activities

Timber harvesting in the South Fork Lost Creek project area has occurred infrequently since the early 1960s. Some harvesting in the early 1960s was in response to a spruce beetle outbreak. These old harvest units are located in the alpine terrain of the Cliff Creek drainage. Other harvesting occurred from 1962 to 1981. These harvest units are located mainly in the lower elevations along the South Fork Lost Creek road. One small harvest unit is located just across the South Fork of Lost Creek and two others are located on the ridge south of the South Fork of Lost Creek. No major harvest activity has occurred in this drainage since 1981.

3. Cover Type Representation and Age Class Distributions

The current age class structure by cover type for the SRSF is shown in Table 3-10. A map of all old-growth stands in the SRSF is shown in Figure 3-1. Currently, 45 percent of all stands are 'old' versus an average historical proportion of 29 percent (from the Climatic Section). In the 1930s inventory, 74 percent of the SRSF existed as old stands. Old stand representation has decreased to more nearly reflect the average historical conditions. Also, for the Climatic Section, there has been a very large shift in cover type representation since the 1930s from shade-intolerant (seral) species to the shade-tolerant climax species. The shift is especially prominent in the mixed conifer type (over 12 times as many acres). The trend is similar across the entire ICRB where shade-intolerant species, in moist forests, have decreased by 86 percent while shade-tolerants have doubled compared to historical amounts (ICRBEMP, 1997), but much more extreme within the SRSF.

Mixed conifer stands dominated by western red cedar comprise 874 acres on the SRSF, and 462 acres in the South Lost project area. This compares to the 1930s inventory that found no cedar dominated stands in the South Lost project area and only 123 acres forest wide.

Age class distributions and cover type representation in the South Fork Lost Creek project area are shown in Table 3-11. Note the larger proportion of old-growth stands in the South Fork Lost Creek area than the SRSF as a whole. Also, the project area is very heavily skewed to shade-tolerant species cover types. The two conditions indicate an area free from disturbance for many years (demonstrated in the fire regimes analysis). The HTG's (Table 3-7) indicate an appropriate condition would contain a higher representation of shade-intolerants than is currently the situation.

4. Habitat type groups and cover type representation

The habitat type of a piece of ground and habitat type groups do not change over time. However, the cover types existing on any HTG can and do change with succession, fire, insects and disease. Table 3-7

TABLE 3-10. CURRENT COVER TYPE BY AGE CLASS FOR SRSF

COVER TYPE	ACRES	Age 0-39	Age 40-99	Age 100-Old Growth	Old Growth
Subalpine	3,452	489	631	605	1,727
Douglas-fir	481	74	207	46	153
Hardwood	21	21			
Lodgepole Pine	2,317	247	1,699	372	
Mixed Conifer	17,374	1,873	2,199	3,974	9,327
Non-stocked	1,030	1,030			
Ponderosa Pine	2,403	1,148	91	297	868
Western Larch/ Douglas-fir	7,754	2,425	1,790	781	2,757
White Pine	3,772	486	65	720	2,501
Total Acres	38,604	7,793	6,683	6,796	17,333
Percent	100%	20%	17%	18%	45%

FIGURE 3-1. OLD GROWTH STANDS BY COVER TYPE FOR SRSF.

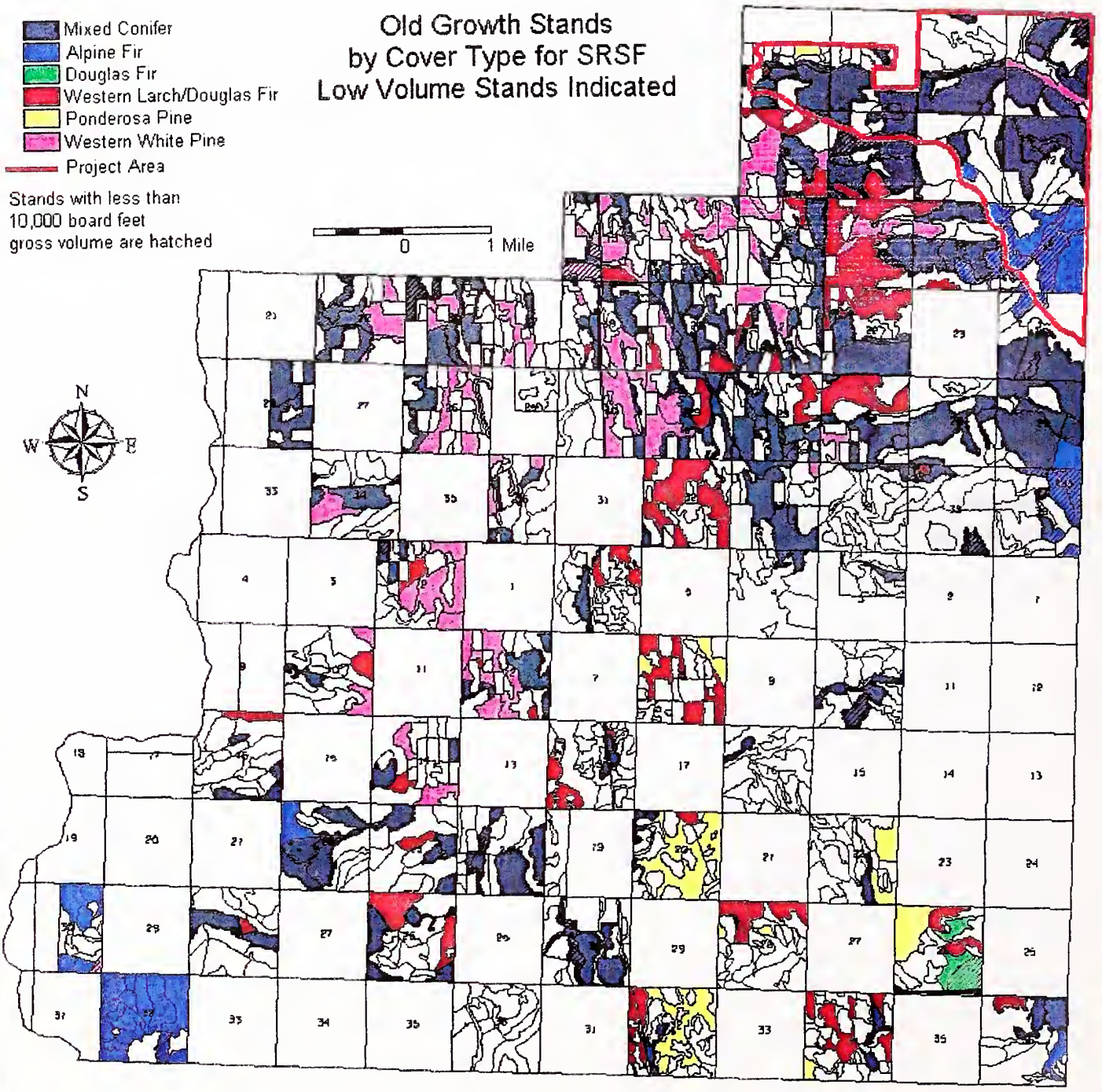


TABLE 3-11. CURRENT AGE BY COVER TYPE IN SOUTH FORK LOST CREEK PROJECT AREA

Cover Type	No Age	Age 0-39	Age 40-99	Age 100-Old Growth	Old Growth	Total
Subalpine		309.1	0.2	268.9	527.3	1,105.5
Douglas-fir				10.9		10.9
Mixed Conifer		87.6	266.4	486.2	1,729.1	2,569.3
Non-forested	132.1					132.1
Non-stocked		0.4				0.4
Ponderosa Pine		36.9			23.1	60.0
Western Larch/Douglas-fir		137.2	40.7	1.8	4.4	184.1
White Pine		20.9		15.6	62.7	99.2
TOTAL	132.1	592.2	307.3	783.3	2,346.7	4,161.7

shows the representation of habitat type groups on the SRSF and the South Fork Lost Creek project area.

5. Structural Characteristics

Current structural characteristics are defined as single-story, two-story or multi-story. Within the South Fork Lost Creek project area, 1,100 acres are in single-story stands; 409 acres are two-story stands; 1,678 acres are multi-story sawtimber stands; 108 acres of even aged clumps; and 1034 acres of uneven aged stands. In the past, the only structural measure was tied to age, so accurate comparisons to past conditions can not be made.

6. Patch Characteristics

Current patch characteristics of size and shape index by cover type are shown in Tables 3-12 and 3-13. The tables show that patches in the South Fork Lost Creek project area tend to be larger than on the remainder of the SRSF, particularly the mixed conifer type. These large patches of mixed conifer reflect succession and the lack of disturbance and are approximately twice the size of historical mixed conifer patches. Patch shape complexity is roughly the same on SRSF as on the South Fork Lost Creek project area.

Patch sizes and shape indices for the SRSF and the South Fork Lost Creek project area by age class are shown in Tables 3-14 and 3-15. Old growth patches in the project area are considerably larger and slightly less complex than for the SRSF. The reduction in old growth patch size since the 1930s inventory is especially obvious. Some of this reflects real conditions, but some is simply an artifact of the 1930s sampling method where considerable lumping of stands occurred. A single 14,000 + acre western larch/ Douglas-fir stand from the early inventory has been fragmented into numerous stands through harvesting and succession. Additionally, a more intense sampling scheme with a smaller minimum patch size has artificially broken up that large patch in the GIS (Leeper and McLeod, unpublished report).

TABLE 3-12. PATCH SIZE AND SHAPE INDEX BY COVER TYPE FROM THE CURRENT INVENTORY ON THE SRSF. PATCH SIZE EXPRESSED IN ACRES FOR PATCHES OF EQUIVALENT COVER TYPE. PATCH SHAPE DERIVED FROM THE INDEX OF MCGARIGAL AND MARKS (1994).*

Patch Size	number of patches	Minimum	Mean	Median	Max	Standard Deviation
Subalpine	15	7.1	235.0	123.1	1,415.6	369.3
Douglas-fir	16	9.3	30.0	21.5	117.1	28.8
Hardwood	1	20.8	20.8	20.8	20.8	N/A
Lodgepole Pine	46	5.9	50.0	24.8	450.8	73.9
Mixed Conifer	97	5.6	178.7	32.7	4,551.4	576.1
Non-stocked	47	5.3	19.9	18.5	55.4	11.1
Ponderosa Pine	53	5.6	45.2	20.5	297.0	66.9
Western Larch/Douglas -fir	118	5.1	65.4	30.0	971.7	124.8
White Pine	57	5.3	66.0	31.8	510.3	89.3
OTHER	51	5.7	24.4	15.1	125.4	24.3
TOTAL	501	5.1	79.3	23.3	4,551.4	277.1

Patch Shape	number of patches	Minimum	Mean	Median	Max	Standard Deviation
Subalpine	15	1.055	1.647	1.605	3.129	0.510
Douglas-fir	16	1.019	1.393	1.356	2.602	0.387
Hardwood	1	1.805	1.805	1.805	1.805	N/A
Lodgepole Pine	46	1.077	1.458	1.346	2.430	0.333
Mixed Conifer	97	1.022	1.661	1.464	7.796	0.813
Non-stocked	47	1.020	1.410	1.410	1.989	0.227
Ponderosa Pine	53	1.035	1.411	1.297	3.586	0.429
Western Larch/Douglas -fir	118	1.010	1.467	1.304	3.259	0.488
White Pine	57	0.997	1.660	1.513	4.082	0.652
OTHER	51	1.050	1.901	1.492	5.963	0.985
TOTAL	501	0.997	1.562	1.411	7.796	0.630

** The patch shape index of McGarigal and Marks (1994) calculates patch shape complexity. The calculation uses the perimeter and area of each patch, and corrects for the effects of patch size. A perfectly square patch takes a value of 1. Circular patches have a complexity value less than 1. More irregular shapes take numbers higher than 1.*

TABLE 3-13. PATCH SIZE AND SHAPE INDEX BY COVER TYPE FROM THE CURRENT INVENTORY ON THE SOUTH FORK LOST CREEK PROJECT AREA. PATCH SIZE EXPRESSED IN ACRES FOR PATCHES OF EQUIVALENT COVER TYPE. PATCH SHAPE DERIVED FROM THE INDEX OF MCGARIGAL AND MARKS (1994).*

Patch Size	number of patches	Total	Minimum	Mean	Median	Max	Standard Deviation
Subalpine	2	1,095.7	139.0	547.9	547.9	956.7	578.2
Douglas-fir	1	10.9	10.9	10.9	10.9	10.9	N/A
Hardwood	0	-	-	-	-	-	-
Lodgepole Pine	0	-	-	-	-	-	-
Mixed Conifer	3	2,565.8	36.7	855.3	303.3	2,225.7	1,194.3
Non-stocked	0	-	-	-	-	-	-
Ponderosa Pine	2	60.0	12.5	30.0	30.0	47.6	24.8
Western Larch/ Douglas-fir	7	181.3	5.1	25.9	20.2	50.3	17.6
White Pine	3	99.2	15.6	33.1	16.0	67.6	29.9
OTHER	7	130.3	8.5	18.6	13.1	34.0	10.7
TOTAL	25	4,154.6	5.1	165.7	20.2	2,225.7	470.5

Patch Shape		Minimum	Mean	Median	Max	Standard Deviation
Subalpine		1.565	1.797	1.797	2.029	0.328
Douglas-fir		1.017	1.017	1.017	1.017	N/A
Hardwood		-	-	-	-	-
Lodgepole Pine		-	-	-	-	-
Mixed Conifer		1.421	2.181	1.954	3.167	0.895
Non-stocked		-	-	-	-	-
Ponderosa Pine		1.058	1.255	1.255	1.452	0.279
Western Larch/ Douglas-fir		1.044	1.184	1.098	1.425	0.150
White Pine		1.124	1.683	1.718	2.208	0.543
OTHER		1.096	1.681	1.459	2.476	0.557
TOTAL		1.017	1.551	1.421	3.167	0.550

** The patch shape index of McGarigal and Marks (1994) calculates patch shape complexity. The calculation uses the perimeter and area of each patch, and corrects for the effects of patch size. A perfectly square patch takes a value of 1. Circular patches have a complexity value less than 1. More irregular shapes take numbers higher than 1.*

TABLE 3-14. PATCH SIZE AND SHAPE INDEX BY AGE CLASS FROM THE CURRENT INVENTORY ON THE SRSF. PATCH SIZE IS EXPRESSED IN ACRES FOR PATCHES OF EQUIVALENT AGE. PATCH SHAPE DERIVED FROM THE INDEX OF MCGARIGAL AND MARKS (1994).*

Patch Size	number of patches	Total	Minimum	Mean	Median	Max	Standard Deviation
000-039	207	7,791.8	5.1	37.6	19.9	395.5	50.9
040-099	101	6,670.1	3.4	66.0	24.6	1,326.3	150.7
100 to Old Growth	122	6,827.8	5.1	56.0	31.2	458.1	81.3
Old Growth	99	17,208.2	6.2	173.8	34.1	9,361.1	941.7
Total	529	38,498.0	3.4	72.8	23.9	9,361.1	417.0

Patch shape	Minimum	Mean	Median	Max	Standard Deviation
000-039	0.9878	1.3784	1.3209	2.4285	0.3130
040-099	0.9960	1.4512	1.2807	3.2230	0.4231
100 to Old Growth	1.0424	1.5218	1.3801	4.0754	0.4705
Old Growth	1.0296	1.8122	1.5614	10.0486	1.1028
Total	0.9878	1.5066	1.3656	10.0486	0.6109

** The patch shape index of McGarigal and Marks (1994) calculates patch shape complexity. The calculation uses the perimeter and area of each patch, and corrects for the effects of patch size. A perfectly square patch takes a value of 1. Circular patches have a complexity value less than 1. More irregular shapes take numbers higher than 1.*

TABLE 3-15. PATCH SIZE AND SHAPE INDEX BY AGE CLASS FROM THE CURRENT INVENTORY ON THE SOUTH LOST PROJECT AREA. PATCH SIZE IS EXPRESSED IN ACRES FOR PATCHES OF EQUIVALENT AGE. PATCH SHAPE DERIVED FROM THE INDEX OF MCGARIGAL AND MARKS (1994).*

Patch Size	number of patches	Total	Minimum	Mean	Median	Max	Standard Deviation
000-039	10	582.0	8.9	58.2	15.6	396.8	119.8
040-099	2	307.1	35.6	153.6	153.6	271.5	166.8
100 to Old Growth	11	770.2	5.8	70.0	36.7	242.0	73.9
Old Growth	7	2,341.8	20.5	334.5	44.5	1,792.1	655.4
Total**	30	4,001.1	5.8	133.4	29.7	1,792.1	330.8
**Does not include nonforested stands or polygons less than 5 acres							

Patch shape	Minimum	Mean	Median	Max	Standard Deviation
000-039	0.9953	1.2208	1.0946	1.9707	0.2879
040-099	1.4711	1.7345	1.7345	1.9979	0.3725
100 to Old Growth	1.0500	1.5316	1.4325	2.5191	0.4340
Old Growth	1.2027	1.7191	1.3671	3.4584	0.8016
Total**	0.9953	1.4853	1.3055	3.4584	0.5204
**Does not include nonforested stands or polygons less than 5 acres					

* *The patch shape index of McGarigal and Marks (1994) calculates patch shape complexity. The calculation uses the perimeter and area of each patch, and corrects for the effects of patch size. A perfectly square patch takes a value of 1. Circular patches have a complexity value less than 1. More irregular shapes take numbers higher than 1.*

7. Stand Vigor

Stand vigor is improved when slow-growing, diseased, or insect-infested trees or stands are harvested and replaced with new growth through regeneration. Tables 3-16 and 3-17 show the current stand vigor for all stands on the SRSF and those within the South Lost project area, respectively.

The four generally recognized vigor classes are: full, good-to-fair, fair-to-poor, and very poor. (These vigor classes are defined in the SRSF Stand Level Inventory)

Full vigor. Forests in this class have an open canopy and growth is optimal. An example of a stand in this class would be young, immature, and probably in the seedling or sapling stage. Only 133 acres within the project area are at full vigor.

Good-to-fair vigor. Stand canopies are mostly closed with crown ratios (the vertical height of a tree's crown compared with the total vertical height of the tree) between 33 and 50 percent. Growth rates exceed mortality in these stands. A stand in this class would be young, merchantable saw timber. Good-to-fair vigor stands occupy 1,625 acres in the project area.

Fair-to-poor vigor. Stand canopies are tightly closed with crown ratios less than 33 percent. Growth and mortality rates are nearly balanced. An example of a stand in this class would be an old stand of merchantable saw timber. Fair-to- poor vigor stands occupy 1,619 acres in the project area.

Very poor vigor. Stands in this class are similar to the fair-to-poor class, but generally are in a decadent condition caused by competing vegetation, insects, diseases and/or old age. Typically in these stands, mortality rates exceed growth rates. Poor vigor stands occupy 646 acres in the project area, all of them at risk to insects and disease.

TABLE 3-16. VIGOR OF STANDS ON THE SRSF

AGE CLASS	ACRES	NONE	1 (Full)	2 (Good-to- Fair)	3 (Fair-to-Poor)	4 (Very Poor)
Non-forest	1,284	1,284				
000-039	7,793	1,415	1,706	4,657	15	
040-099	6,683		672	5,132	864	15
100-Old Growth	6,796		162	5,267	1,172	194
Old Growth	17,333			5,432	8,485	3,415
TOTAL	39,888	2,700	2,540	20,488	10,536	3,625

TABLE 3-17. VIGOR OF STANDS IN THE SOUTH LOST PROJECT AREA

AGE CLASS	Acres	None	1 (Full)	2 (Good-to-Fair)	3 (Fair-to-Poor)	4 (Very Poor)
Non-forest	133	133				
000-039	593	0	77	504	12	
040-099	307		61	246		
100-Old Growth	782			526	223	33
Old Growth	2,347			349	1,385	614
TOTAL	4,162	133	138	1,625	1,619	646

8. Insects and Diseases

Bark beetles, Armillaria root rot, dwarf mistletoe, white pine blister rust and Indian paint fungus are the main insects and diseases that occur within these habitat type groups. In the project area root diseases play a major role in regulating stand composition and stocking forest types in the area (Monnig and Byler 1992). Under natural conditions, Douglas-fir and true firs tend to be susceptible to root disease. Stands dominated by more-resistant species such as western larch and western white pine are perpetuated where root disease is present. These stands are more resistant to root diseases.

9. Indicators of "Old Growth" Attributes

We recognize that our desired management strategy under the SFLMP is to retain, in reasonable proportions, stands that contain all the naturally occurring combinations of attributes, including those associated with old growth stands. Thus, in this section, we display current conditions with regard to attributes often associated with old growth. The attributes displayed are stand structure, vigor, numbers of large trees, snags, amount of coarse woody debris, and gross volume per acre.

Lacking are surveys that are specifically oriented to clearly identifying all the stand characteristics that would characterize old-growth. However, indices were derived from data in our Stand Level Inventory, which summarized the abundance of 4 attributes that often, but not always, characterize stands in the latter stages of development: large live trees, snags, coarse down-woody material, and decadence among live trees. In each case, a standard step-by-step procedure was used (see Appendix C) that integrated information from more than 1 field in the Stand Level Inventory to produce a single index. Briefly, the "large tree" index measures the relative abundance of trees more than 21 inches in diameter. The snag index measures the relative abundance of large, dead trees, with greater weight given to larger-diameter snags, but equal weight given to snags by their species and other characteristics. Similarly, the coarse-down-woody-material index measures the relative abundance of down woody material, with greater weight given the larger diameter logs, regardless of species or degree of rot. Vigor of old growth stands is discussed as a surrogate for stand decadence. Stands with higher vigor ratings are those with lower decadence and *vice versa.*

In each case, only 4 categories of abundance were used, which corresponded roughly to the four adjectives:

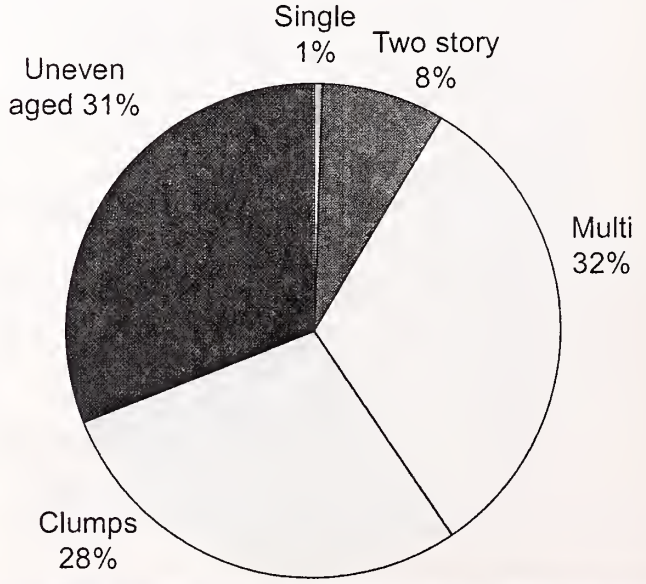
- "none"
- "few" (or "little")
- "some" (i.e., a 'typical' amount for a stand of that forest type and age, neither particularly few or many)
- "many" (or "much")

This description is necessarily crude: we cannot describe existing conditions or model future effects with greater resolution than our current inventory allows. However, our understanding of the naturally occurring abundances and dynamics of these old-growth attributes is similarly crude. Thus, even were a more precise description or assessment possible, we are unsure the additional resolution would be informative. We believe, moreover, that despite their inevitable approximations, these descriptions and assessments are generally accurate and objective and serve as useful proxies to guide our more general evaluation of diverse forest types and structures.

a) Stand Structure Of Old Growth

The structure of forested stands indicates one characteristic often associated with "old growth", namely whether or not the stand is in a multi-storied condition. The multi-storied condition arises when a stand has progressed through succession to the point that shade tolerant species are replacing a shade intolerant over-story. It can also occur when a stand is already dominated by large old shade tolerant species and through gap replacement the regeneration that occurs is also shade tolerant. The former is the more common case in forests of Montana. In both cases the time since a major disturbance tends to be long helping to create many of the attributes important in old growth. Figure 3-2 displays the current conditions for stand structure of old growth on the SRSF. As can be seen the vast majority of SRSF old growth has multiple canopy levels, and is nearly evenly split among classic uneven aged, multi-storied, and clumps of even aged trees.

FIGURE 3-2. STRUCTURE OF OLD GROWTH STANDS ON THE SRSF.

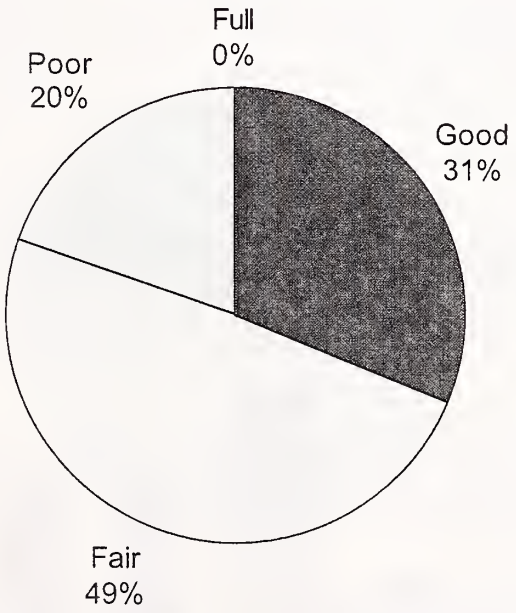


b) Stand Vigor of Old Growth

Vigor of old growth stands is used to indicate relative decadence. Low vigor, old growth is more likely to have more snags, and have greater amounts of large down woody debris than would be expected with high vigor stands. Stand vigor is explained in section Chapter 3 II.D.7. Figure 3-3 shows the vigor classes, by percentage for old-growth stands on the SRSF. As would be expected no old-growth stands are at full vigor. Most stands are in the good and fair classes.

Stands having good to fair vigor are likely to remain relatively stable for the next several decades. Some trees would continue to die maintaining the presence of snags and large down logs. In stands with poor vigor mortality is currently exceeding growth. It is expected these stands would continue to decline, adding to snag and coarse woody debris levels.

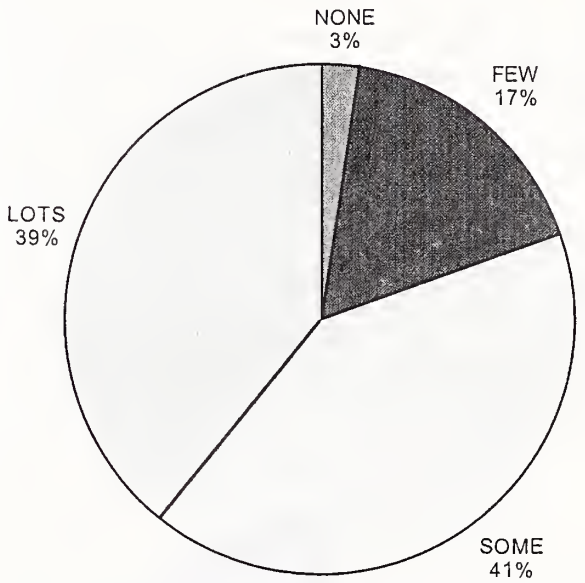
FIGURE 3-3. VIGOR CLASS FOR OLD GROWTH STANDS ON THE SRSF.



c) Large Trees Per Acre

Figure 3-4 shows the relative abundance of large trees in old growth stands on the SRSF. As can be seen, approximately 39% of all old growth stands have the highest abundance category for numbers of large live trees with 41% having the 'some'. the next highest amount.

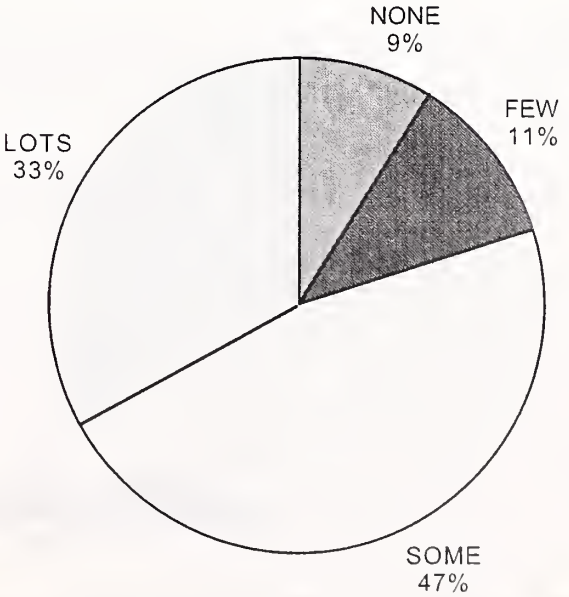
FIGURE 3-4. CURRENT NUMBERS OF LARGE TREES PER ACRE ON THE SRSF.



d) Snags Per Acre

Figure 3-5 shows the relative abundance of large snags in old growth stands on the SRSF. The preponderance of stands have some or lots of large snags. The few category represents DNRCs minimum for snag retention post harvest. We expect that snag numbers would be higher except for a long term salvage program implemented prior to the SFLMP ROD being issued.

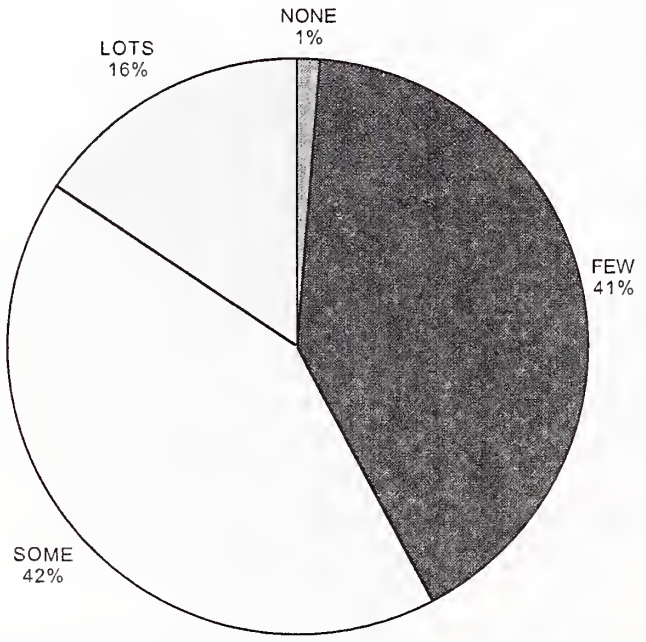
FIGURE 3-5. CURRENT SNAG NUMBERS PER ACRE FOR OLD GROWTH ON THE SRSF.



e) Amounts of Down, Coarse Woody Debris

Figure 3-6 shows the relative abundance of down, coarse-woody debris in old growth stands on the SRSF. As with the snag numbers we expect that salvage operations have reduced the amount of CWD in old growth stands on much of the SRSF resulting in a preponderance of stands in the some and few categories.

FIGURE 3-6. CURRENT LEVELS OF COARSE WOODY DEBRIS FOR THE ENTIRE SRSF.

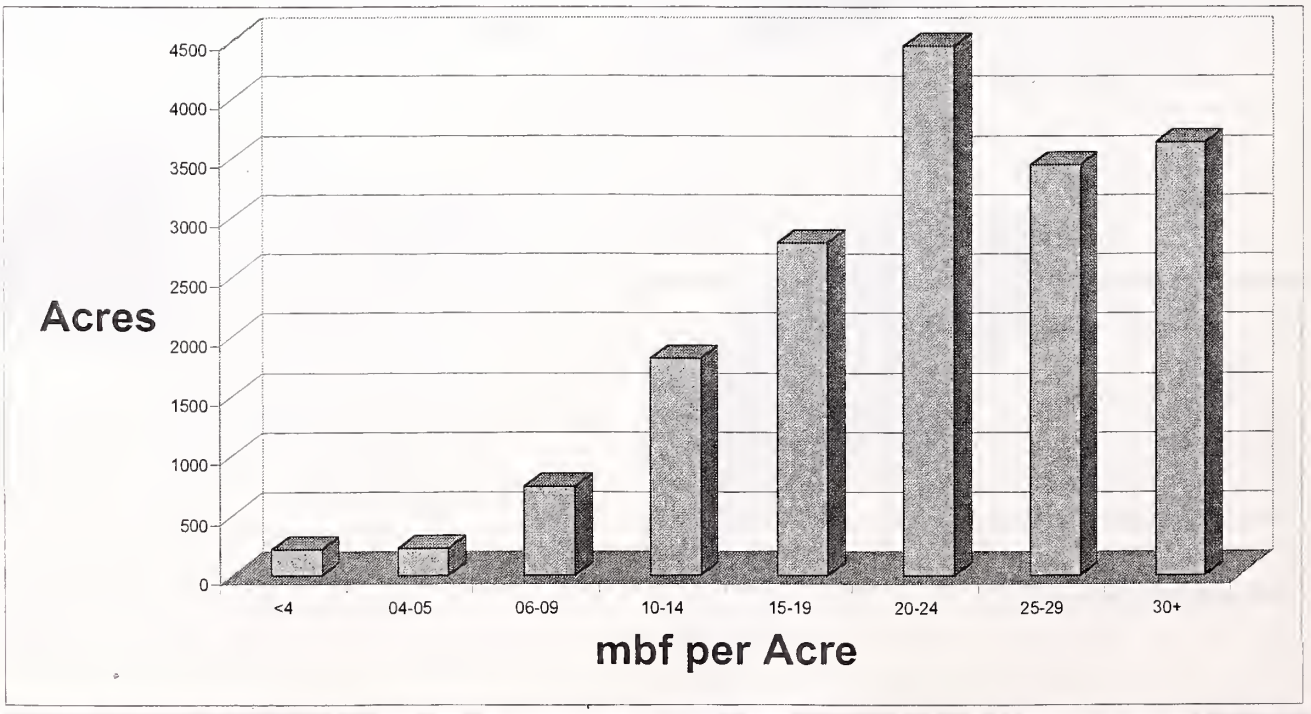


f) Gross Volume Per Acre

Another attribute of old-growth stands often deemed important and for which distributions can be quantified and effects assessed is a measure of density, or stocking. In this case, the stand gross board-foot volume per acre is used (Figure 3-7). Higher volumes indicate more densely stocked stands. One value of gross volume as a measure is that effects of in-growth and lack of wildfires are minimized because only trees larger than 9 inches dbh are included. Thus, it becomes another measure or barometer through which impacts on the character of old-growth stands can be measured.

As can be seen a very small proportion (about 6 percent) of old growth on the SRSF contains less than 10 mbf per acre. Those stands with < 4 mbf per acre are considered old growth only if they have never been harvested. They are primarily limited to hot, dry slopes where ponderosa pine may be the only species growing, or limited to high elevation, cold subalpine types. About 1 percent of the old growth on the SRSF is comprised of stands with < 4 mbf per acre. Approximately 65 percent of the old growth on the SRSF contains over 25 mbf per acre.

FIGURE 3-7. CURRENT GROSS VOLUME (MBF) PER ACRE IN OLD GROWTH ON THE SRSF.



Cumulative Effects: Previous Treatments in Classified Old Growth

The SRSF has had an on-going salvage and sanitation program for years. This program has resulted in many current old growth stands having had some old growth attributes reduced through the effects of timber harvest. The effects of these previous entries include lower attribute levels in the following categories discussed below: fewer acres with high numbers of large trees, lower snag numbers, and less down, coarse woody debris. Table 3-18 shows the acres of old growth treated in various methods for the SRSF and the South Lost project area.

10. Appropriate Forest Conditions

Appropriate or desired future conditions are described for cover-type representation. Additionally, old-growth minimums and an old-growth recruitment schedule are displayed for Swan River State Forest.

Relationship to SFLMP Old Growth Commitment

The SFLMP requires the maintenance of old growth in amounts equal to at least one half of that expected to occur with natural conditions (see Old Growth Commitments from the SFLMP). This section describes how to determine that minimum. The management for old growth amounts is best conducted for the entire SRSF as opposed to a third order drainage, so as to avoid creation of homogeneous forests spread across the landscape with equivalent proportions of cover types and age classes in each. Such an approach also facilitates the development and maintenance of large blocks of contiguous old growth and provides for the mechanisms to maintain and enhance connection between old growth stands. Both western Montana and the Climatic Section are big enough to represent general trends and average conditions whereas the 39,000-acre SRSF is too small. Data from SRSF and the South Fork Lost Creek project area are useful for examining trends in vegetative change brought about through succession, fire suppression, harvesting and other activities, but the small size of these areas prevents their use in determining long term appropriate conditions; therefore, we are using historical conditions for the Upper Flathead Valley (Climatic Section 333C) to determine the appropriate proportion of old growth stands, by cover type, to maintain on the SRSF.

Cover Type Representations and Old-Growth Minimums

To determine appropriate conditions, a set of filters was developed to use on our SLI. As a first step, this procedure looks at current species representation to determine what would be an appropriate condition in terms of cover-type representation across the entire Swan River State Forest.

TABLE 3-18. ACRES OF OLD GROWTH HAVING BEEN TREATED IN THE PAST AND TYPE OF TREATMENT. THE SRSF NUMBERS INCLUDE TREATMENTS MADE IN SOUTH LOST PROJECT AREA STANDS.

Area	Timing of Treatment	Salvage	Sanitation	Individual Tree Selection	Group Selection	Seed Tree	Unknown
SRSF	over 30 years ago	100					2,587
	less than 30 years ago	5,735	132	622	128	66	173
South Lost	over 30 years ago			37			81
	less than 30 years ago	4		340		4	

Table 3-19 describes the protocol for assigning appropriate cover types from our current inventory. Stands are evaluated against the criteria in the table beginning with white pine and proceeding down the Cover Type column. Once assigned, a stand is not evaluated against other cover-type criteria. This procedure is referred to as the Appropriate Conditions Filter. For example, if our Stand Level Inventory (SLI) shows that a stand is currently composed of ≥ 10 percent of white pine, then the stand is categorized as an appropriate white pine stand. A subsequent stand may have < 10 percent white pine and ≥ 20 percent ponderosa pine in its current composition. This stand would be categorized as an appropriate ponderosa pine stand. This procedure has been applied to all stands on the SRSF in accordance with Table 3-19, until all stands have been categorized into their appropriate conditions. There is no supposition that this filter is the end-all, be-all indicator of appropriate conditions. Rather it represents a methodology, founded in succession theory, that we use for a first approximation of appropriate cover type representation. Additionally, local knowledge of particular stands by unit foresters, and inventory specialists was used to adjust the Appropriate Conditions filter. Suggestions were used to define a future condition more suited to the SRSF landscape.

The minimum proportions of old-growth stands to be retained, by cover type, are calculated by multiplying the appropriate proportion of cover types by one-half the proportion of each cover type that existed in the 1930s inventory as old stands at the climatic section level. The product is then multiplied by the forested acres (38,604) on Swan River State Forest to indicate the minimum acres of old-growth stands to maintain. The appropriate proportion of cover types is merely the proportion of appropriate acres of each cover type (based on the Appropriate Conditions filter) for the entire Swan River State Forest. See Table 3-20 for the appropriate proportion of old growth on the Swan River State Forest.

To determine current amounts of old growth cover types were assigned from DNRC's current Stand Level Inventory to cover types matching those described in the historical data. Table 3-21 takes the minimum proportions from Table 3-20 and

TABLE 3-19 - PROTOCOL FOR ASSIGNING APPROPRIATE CONDITIONS BY COVER TYPES

Cover Type*	Proportional Representation (%) of Species in Each Cover Type				
	Ponderosa Pine	**Douglas-fir**	**Western Larch**	**Western White Pine**	**Lodgepole pine**
Western white pine				≥10	
Ponderosa pine	≥20				
Western larch/Douglas-fir		Western larch/Douglas-fir ≥30 (western larch present)			
Douglas-fir		≥50			
Lodgepole pine					≥40
Mixed conifer	Habitat type <630 and stands not yet assigned				
Subalpine types	All remaining stands				

* *types were assigned in the order listed. Once assigned a stand was not subjected to subsequent assignment criteria.*

TABLE 3-20. MINIMUM PROPORTION OF SRSF TO MAINTAIN AS OLD GROWTH STANDS FOR EACH COVER TYPE. THE AVERAGE PROPORTION INDICATES THE PROPORTIONAL AREA OCCUPIED BY EACH COVER TYPE FROM THE CLIMATIC SECTION.

Cover Type	Appropriate Proportion of SRSF	_ Old-Stand Percentage Losensky*	Percentage of SRSF to manage as old growth stands
Ponderosa pine	5.33%	37%	1.97%
Douglas-fir	1.48	3	0.04
Western larch / Douglas-fir	41.62	23.5	9.78
White pine	26.43	8.5	2.25
Lodgepole pine	4.16	2.5	0.10
Mixed conifer	13.53	21.5	2.91
Subalpine	7.39	10	0.74
TOTAL	100		17.79

**The old-stand proportion from Losensky is the proportion of each cover type that was over 170 years old for ponderosa pine, Douglas-fir, and western larch/Douglas fir; over 140 years for lodgepole pine, and over 180 years for the other types See Table 3-4.*

multiplies them by the forested acres in the SRSF to determine the minimum acres of old-growth stands to maintain in particular cover types. It also shows the current representation of old growth. As shown in Table 3-21, there are sufficient acres of old-growth stands in all but the western larch/ Douglas-fir and lodgepole pine cover-type classes; the lodgepole type currently does not exist in the project area and thus would not be affected. Overall, minimum retention of old growth is 6,689 acres, whereas current amount of old growth is 17,333 acres.

Old-Growth Network

The Biodiversity Resource Management Standard (RMS) #6 in the SFLMP states, "Within an appropriate analysis area, DNRC would seek to maintain or restore old-growth forest in amounts of at least half the average proportion that would be expected to occur with natural processes on similar sites." In order to meet that RMS, DNRC has shown in Table 3-21 that the amount of old growth that currently exists on the SRSF (17,333 acres) substantially exceeds the amount that would represent the 50 percent minimum (6,869 acres) required under Biodiversity RMS #6. In an effort to ensure that we maintain old-growth stands that provide habitat for old-growth associated species, DNRC has identified a preliminary network of old-growth stands that would not only meet the commitment to maintain a minimum of 50 percent of average historical levels of old growth, but would also provide an old-growth network that considered spatial arrangements and patch characteristics of old-growth stands. This old-growth network is strictly a DNRC planning tool to help us refine and develop alternatives during project-level planning. We fully expect that future project-level development and new information will lead to more extensive on-the-ground review of old-growth stands identified as part of the network. This additional review may result in adjustments or refinements, which should over time improve the functionality of the old-growth network. A more in-depth explanation of the old-growth network can be found in the project file.

Replacement Old Growth Schedule

The SFLMP calls for the maintenance of sufficient stand acres to replace old growth stands that may fall apart, die or burn. The proportions were calculated using a Weibull function for age class

TABLE 3-21. THE MINIMUM NUMBER OF ACRES IN THE SRSF TO BE MAINTAINED AS OLD GROWTH STANDS FOR EACH COVER TYPE.

Cover Type	Proportion of SRSF to manage as old growth	Minimum acres to maintain as old growth on SRSF	Existing acres of old growth on SRSF
Ponderosa pine	1.97%	760	868
Douglas-fir	0.04	17	153
Western larch / Douglas-fir	9.78	3,775	2,757
White pine	2.25	869	2,501
Lodgepole pine	0.10	39	0
Mixed conifer	2.91	1,123	9,327
Subalpine	0.74	286	1,727
TOTAL	17.79	6,869	17,333

**There are 38,604 forested acres on the SRSF*

distribution. The Weibull function uses both the fire return interval and a shape parameter to fit the age class curve. This curve indicates the proportion of stands needed in each age class. Table 3-22 shows the cover types and the percentages of stands needed in the 110-year age class and younger age classes, and the percentages necessary for the age classes between 110 and 150 years. Age classes cover 10 years, e.g., the 110 class is from 110 to 119 years.

11. Current Forest Condition Summary

The data indicate that SRSF and the South Fork Lost Creek project area in particular are considerably older forests, with greater shade-tolerant tree representation than would be expected to occur under average historical conditions. However, old growth representation has decreased since the 1930s from 74 percent of the SRSF to 45 percent currently, thereby moving the forest toward the DNRC calculated minimum of old growth at 17.79 percent (see Table 3-20). Fifty-six percent of the project area is in old growth stands. SRSF currently has about 2.5 times more acres of old growth stands than the minimum commitment from the SFLMP, although much of the over representation is concentrated in mixed conifer and white pine stands.

In general, old growth cover types have shifted from shade-intolerant dominated (89 percent of historical old stands) to domination by mixed conifer and subalpine cover types (64 percent of old growth stands). The historical matrix of old western larch/Douglas-fir stands has been replaced, but by no single type or age class. The project area contributes significantly to the shifting cover type trend. The old, shade-tolerant dominated stands in the South Fork Lost Creek drainage are also of generally less than full vigor, with a high proportion of them at risk.

The SRSF is more fragmented, with smaller cover type patch sizes than historically. Patches of old growth also have decreased in size, although patch size still averages over 173 acres on the whole forest and 334 acres in the project area. Patch shape complexity on the SRSF is similar to that on the project area, but the shape of old growth patches is less complex on the project area.

Old-growth attributes of the SRSF have decreased due to a long-term salvage program. This salvage program has resulted in over half of the classified old-growth stands having been entered for harvest at least once. We expect attribute levels in those

TABLE 3-22. REPLACEMENT OLD GROWTH STAND SCHEDULE.

Cover Type	Old Growth Target	Percentage in 100 class and each of the younger classes	Percentage in each age class between 110 and 150[1]
Ponderosa Pine[2]	--	--	--
Douglas-fir	3	2.4	1.0
Western larch / Douglas-fir	24	3.5	2.5
White pine	9	3.2	1.9
Lodgepole pine[3]	3	1.8	0.8
Mixed conifer	22	3.5	2.5
Subalpine	10	3.3	2.0

[1] *The 150 class is used because in DNRC inventory that class corresponds best to Losensky's old stand designations.*
[2] *Ponderosa pine - not applicable because targeted management is intended to create the conditions desired*
[3] *Lodgepole pine becomes old growth at 140, so the 0.8 refers to the 140 and younger classes to 110.*

stands to be lower than they would under natural conditions.

The information shows a forest heavily affected by forest succession, resulting from effective fire suppression and a lack of wildfire. The potential for large, catastrophic fires and increased loss to insects and diseases is high, given the shifts in cover types.

12. Sensitive Plants

The South Fork Lost Creek project area falls within four different quadrangles in northwest Montana: Swan Lake, Connor Creek, Thunderbolt Mountain, and Cilly Creek. A search of the Montana Natural Heritage Program (MTNHP) database on sensitive plants was conducted and several plant species of special concern have been previously identified in the Cilly Creek and Swan Lake quadrangles. No plant species of special concern have been identified within the Connor Creek or Thunderbolt Mountain quadrangles. In the Cilly Creek quad, the following plant species have been noted to occur: *Botrychium montanum, Botrychium spathulatum, Carex livida, Carex paupercula, Cypripedium parviflorum, Cypripedium passerinum, Drosera anglica, Eleocharis rostellata, Epipactis gigantea, Eriophorum gracile, Howellia aquatilis, Liparis loeselii, and Meesia triquetra.* In the Swan Lake quad, the following plant species have been noted to occur: *Carex livida, Carex paupercula, Cypripedium parviflorum, Cypripedium passerinum, Dryopteris cristata, Eleocharis rostellata, Epipactis gigantea, Howellia aquatilis, Liparis loeselii, Potamogeton obtusifolius, and Viola renifolia.*

None of the previously listed sensitive plants have been noted within the South Fork Lost Creek project area. Most of these sensitive plant species, including water howellia, occur on very wet, marshy sites, none of which are located within the project area. No wetlands would be affected by the project (Shelly et al. 1995, Project File 601). We don't expect any impacts to sensitive plants from any of the action alternatives.

III. NOXIOUS WEEDS

Spotted Knapweed (*Centaurea maculosa*) and to a lesser extent, St. Johnswort (Hypericum perforatum) occur and on dry sites within the project area, mainly along roadside edges exposed to sunlight. Where knapweed is the dominant vegetation there is less ground cover and above average erosion.

IV. SOIL

A. *SOIL TYPES*

The South Lost Creek valley is a trough formed by alpine glaciation. Dominant soils are deep cobbly silt loam glacial tills on midslopes and gravelly alluvial soils on the valley floor. A narrow band of alluvial soils occurs adjacent to the South Fork Lost Creek. Upper slopes are shallow to moderate depth, glacial till soils and glacial scoured bedrock forming ridges and convex slopes (see figure 3.1).
A brief soils legend and interpretations are attached in Table 3-19. More detailed descriptions are available in the project file and Flathead N.F. Land Inventory.

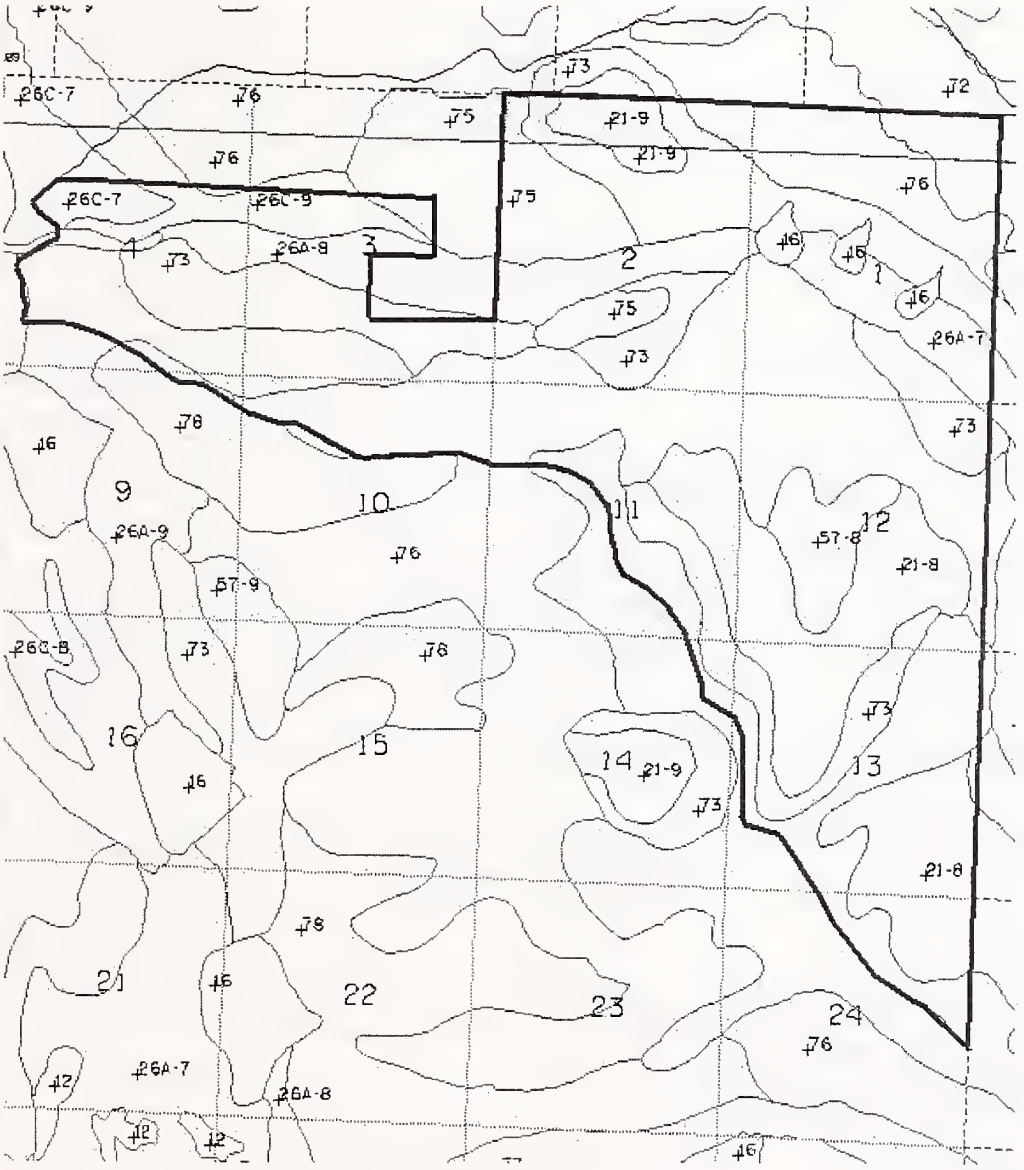
B. *ROADS*

Roads to the proposed project area are mainly of low to moderate standard, and would need varying degrees of work to meet Best Management Practices (BMPs). The main access route to the watershed is on the South Fork Lost Creek Road, which has surface drainage problems over most of its length. The road has little or no surface drainage installed, and some reaches are constructed within the Streamside Management Zone (SMZ). Beyond the locked gate at the concrete bridge, the road becomes low standard, and has several hundred feet of surface erosion and gullying in the Cliff Creek portion of the watershed.

C. *CUMULATIVE EFFECTS TO SOIL PRODUCTIVITY*

Old harvest units located in sections 11, 12 and 13 have a series of skid trails excavated on about 100-foot contours, portions of which have no surface drainage structures or relief pipes. These trails have numerous small trees growing in them, but not much ground-covering vegetation to slow erosion. Several of these trails are producing erosion, gullies and mass failures where surface runoff has been concentrated. Most of the existing harvest units in the lower reaches of the watershed are on more moderate slopes, and skid trail spacing is closer to 150 feet. Some displacement has occurred on these trails, effectively removing the shallow silt loam topsoil. These trails are neither revegetating nor actively eroding. A localized area of marginal slope stability occurs in SW 1/4 of Section 3. A narrow debris flow type slope failure occurred in a forested site due to a combination of factors, including dense glacial till subsoil and concentration of water directed into a draw.

FIGURE 3-8 SOUTH FORK LOST CREEK SOILS MAP



South Fork Lost Creek Soils Map

Soil Type Boundary
Project Area Boundary
73 Soil Type

TABLE 3-23. SOIL TYPE AND RISKS IN THE SOUTH FORK LOST CREEK PROJECT AREA.

Map Unit	Description	Soil Drainage	Road Limitations	Topsoil Displacemcnt & Compaction	Seedling Establishment	Erosion (Bare Surface)	Notes
10-2	Alluvial Soils	Poorly to Well Drained	Mod to Severe	Severe	Good	Low	Streamside managemcnt guides will be applied.
16	Alluvial Fans	Well Drained	Low to Mod	Moderate	Fair	Slight	Deep gravel and shallow surface soils. Beargrass competition common. Avoi displacement.
21-8	Cirque Basin Glacial Till & Residual Soils on 20-40% Slopes	Somewhat Excessive	Mod-Rock on Ridges	Moderate	Fair, Droughty	Moderate	Mod. deep coarse soils reduce water and nutrients south slopes droughty. On slopes over 35% lop and scatter slash, excavator pil or broadcast burn.
21-9	Cirque Basin Glacial Till & Residual Soils on 40-60% Slopes	Somewhat Excessive	Mod-Rock on Ridges	Mod/High	Fair, Droughty	Mod/High	Mod. deep coarse soils reduce water and nutrients south slopes very droughty cable yard slopes over 45% or soft track up to 55% slopes.
26A-7	Deep Glacial Till on 0-20% Slopes	Well Drained	Low	Modcratc (Severe if Wet)	Good	Low	Deep, productive soil well suited to tractor operation. Limited dry season of use.
26A-8	Deep, Silty Soils from Calcareous Glacial Till 20-40% Slope	Well Drained	Modcrate	Moderate	Good	Mod.	Deep, productive soil. Fine textured soil remains moist cbeck soil mosture. Topsoi depth is very important.
26A-9	Deep, Silty Soils in Calcareous Glacial Till 40-50% Slope	Well Drained	Low (Some Rock)	Mod. Compaction High Displacement	Good	Mod. to High	Deep soils, steep slopes limi equipment operations. Cable yarding reduces impacts.
26C-7	Deep Glacial Till 0-20% Slopes	Well Drained	Low	Moderate (Severe if Wet)	Good	Low	Deep, productive soil. Topsoil depth is very important.
26C-9	Deep, Silty Glacial Till 40-60% Slopes	Well Drained	Mod./High	Mod./High	Good	Mod./High	Deep, productive soil, avg. season of use. Limit soft track skidder to slopes less than 45%.
26D-7	Deep Sandy Glacial Till 0-20% Slopes	Well Drained	Low	Moderate (Severe if Wet)	Good	Moderate	Deep soil, low fertility. Topsoil depth is very important.
57-8	Residual Soils & Mod. Deep Glacial Till 20-40%	Well Drained	Moderate	Slight Comp. Mod./Severe Displacement	Fair-Good Droughty on S Slopes	Moderate	Shallow topsoils; use care during brush piling and scarification on slopes less than 40%. On slopes over 40%, plan cable logging or contour skid trails on 150 ft min. spacing.
72	Alpine Ridge Headwalls Slopes > 60%	Excessive	Mod. to Scvcrc (Rocky, Steep)	High Displaccmcnt	Harsh site; poor.	Moderate	Low productivity; few trees
73	Trough Wall Soil Sl Glacial Till and Rocky, Residual ope > 60%	Wcll Drained	Mod. to Severe (Rocky, Steep)	High Displacement	Fair	Mod. to High	Steep slopes require cable operation.
75	Rock, Residual Soils on Steep Slopes	Somewhat Excessive	Rock	Disp. - High	Fair, Droughty	Moderate	Shallow and mod. deep, very gravelly/ rocky soils. Cablc yarding on slopes over 45%, broadcast burn.
76	Geologic Breaklands Slopes Ovcr 60%	Excessive	Severe; Rock Outcrops	High Displacemcnt	Good	High	Steep slopes, rocky soils with common rock outcrops. Cable logging recommende for slopes over 45%. Lop and scatter or excavator pil slash.
78	Glacial Trough wall Slopes over 60%	Excessive	Rocky, Steep	High Displacement	Fair, Droughty	Moderate	Stcep slopes, rocky soils with common rock outcrops Cable logging recommende for slopes over 45%.

V. WILDLIFE

As was previously stated in Chapter 1, the wildlife analysis was completed by a different DNRC biologist than the biologist who conducted the analysis for the FEIS. This analysis for the affected environment (Chapter 3) has been modified in some cases, based on the new inventory data and the biologist's professional judgement. Different methodologies were warranted that more accurately described the current condition of wildlife on the SRSF; these new analysis methods are described in the following analysis.

DNRC recognizes that it is impossible to evaluate the effects of proposed actions on all wildlife species and their specific habitats within any given project area. We assume that if landscape patterns and processes similar to those species evolved with are maintained, then the full complement of species will be maintained across the landscape. Under the SFLMP, we manage State trust lands to maintain or restore a semblance of historic conditions, and make reasonable attempts to engage in cooperative planning efforts with major adjacent landowners (DNRC 1996). This "coarse filter" approach supports diverse populations of wildlife by managing for a variety of forest structures and compositions across a landscape. The following is an analysis of impacts on vegetation and landscapes, and subsequent effects on wildlife. Maps and numerical quantification were accomplished for species addressed in this section using data collected during field reviews, DNRC stand level inventory (SLI) data analyzed using Pamap GIS software, and interpretation of aerial photography.

We acknowledge that it is difficult to ensure that a broad view, such as that taken under the coarse filter, adequately considers all of the important habitat components that may be affected by any given project. Therefore, using a fine filter, we also evaluate individual species and habitats that are known to be sensitive to various forms of habitat alteration and/or human-caused disturbance. These typically include species Federally listed as threatened or endangered, species considered sensitive by DNRC, and big game species managed by DFWP.

A. *COARSE FILTER ASSESSMENT*

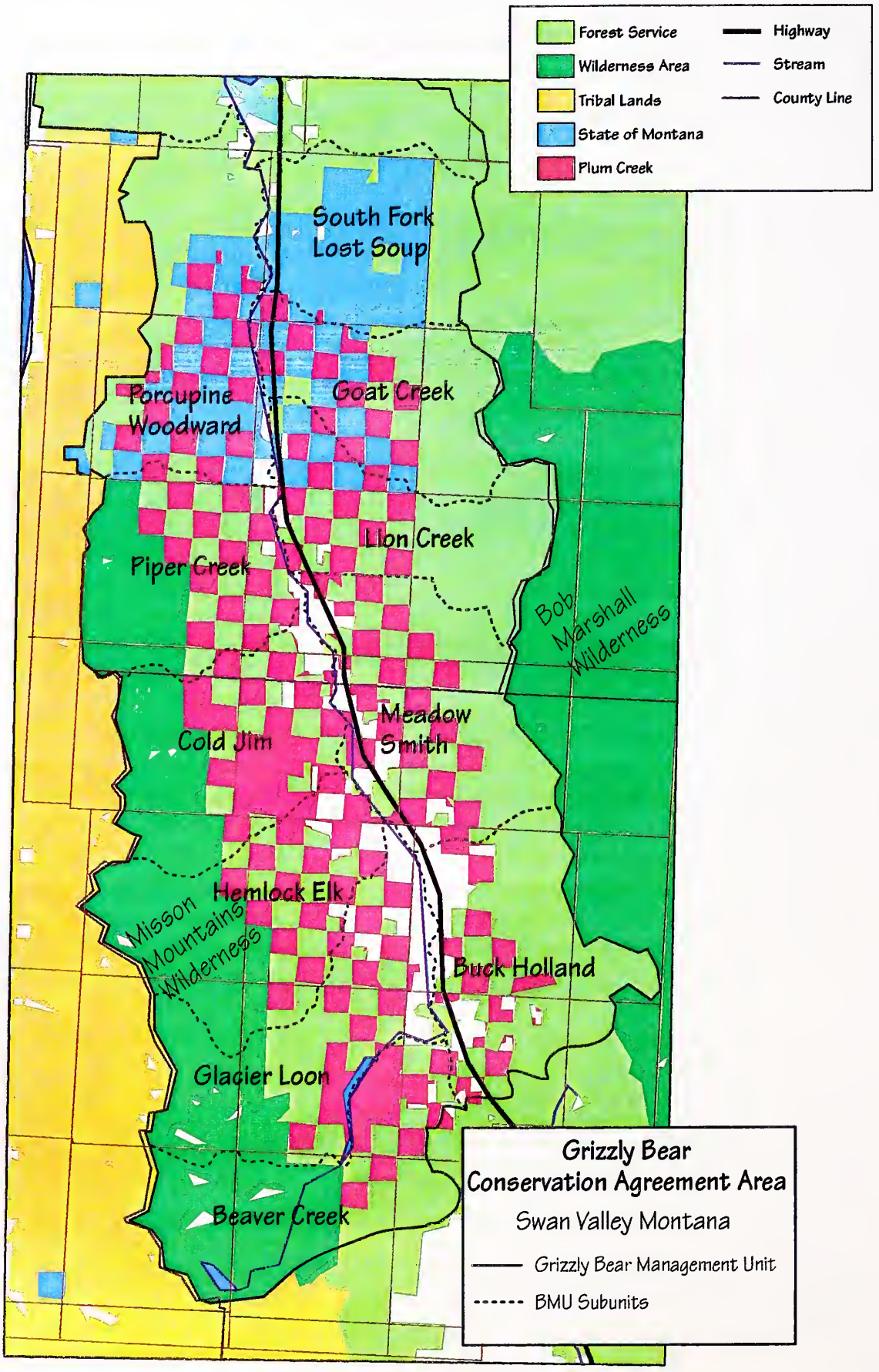
1) Overview

A complete inventory of species is lacking for the SRSF, however, it is likely that the majority of terrestrial vertebrates that were present prior to the arrival of European settlers currently use the SRSF. Also, it is probable that large predators that are often extirpated by man, such as grizzly bears (*Ursus arctos*), lynx (*Lynx canadensis*), and wolverines (*Gulo gulo*), at least occasionally, use habitats found on the SRSF. Gray wolves (*Canis lupus*) are presently not known to occur on the SRSF, but they are likely to expand into the area in the near-term as recovery continues. If any species are lacking on the SRSF, they are likely those that are specialist dependants that rely on habitat-related elements currently in short supply of under threat in the area (e.g., burned forests of varied intensity, western white pine, and whitebark pine).

Wildlife habitats on the SRSF benefit functionally from their close proximity to the adjacent Bob Marshall and Mission Mountains Wilderness areas that are managed by the USFS, Flathead National Forest. However, the existing "checker-board-type" ownership pattern within the SRSF and differing management objectives among landowners in the Swan Valley pose challenges to managers for maintaining a semblance of historic patch sizes and shapes, and connection of dense forest.

Existing human use on the SRSF varies from high use along Highway 83 and open road systems in the flat valley bottom and valley foothills, to low use in the more pristine high elevation roadless areas that are typically densely forested and steep. Dispersed recreation during all seasons and activities associated with logging are the primary human uses that can affect wildlife.

FIGURE 3-9 SOUTH FORK LOST CREEK GRIZZLY BEAR CONSERVATION AGREEMENT



2) Logging

Logging activity within the Swan Valley is the primary disturbance factor that has influenced forest structures during the past 50 years. Preferred treatments in the Swan Valley were often regeneration harvest types that left little in the way of residual forest canopy or structure in treated units. High amounts of regeneration harvest and developed road systems, coupled with the existing checkerboard ownership pattern, have contributed to the creation of relatively small patches of young forests within a matrix of mature forests with greater levels of edge and isolation than would have been expected near the turn of the century (see patch analysis under Vegetation section for more detailed discussion). Some existing clearings with high edge and complex shape were created in the past at the request of wildlife managers seeking to improve habitat conditions for species such as white-tailed deer. The existing mosaic of habitat is one that favors edge adapted species to a greater extent than would have been expected near the turn of the century. Species that prefer large, uninterrupted patches of mature forest cover are likely less-favored or disadvantaged by the current distribution of vegetation. Large-scale reductions of mature and over mature seral tree species through logging (such as western larch) have also reduced the amount of quality habitat substrate for cavity-nesting species.

Past logging has also occurred within the project area that has fragmented mature forest habitat. This has primarily occurred in the west portion of the project area in sections 3 and 4. Harvest units are regeneration-type harvest units that are rectangular and typically less than 60 acres. A large, regeneration harvest patch (~400 acres) that more closely emulates natural disturbance processes occurs in portions of sections 11, 12 and 13; however, structural elements such as snags and snag recruitment trees are lacking in this unit.

Smaller existing clearcut patches in the South Fork Lost Creek drainage are not of shape or size that would have been created through natural disturbance processes. Collectively these units have likely resulted in a net decrease in available cavity nesting habitat and greater levels of edge per unit area than would have been expected through natural disturbance processes. However, a substantial portion of the South Fork Lost Creek drainage remains densely forested with mature or old growth timber distributed in large, well-connected patches that would maintain travel habitat for some species, and provide interior forest habitat across relatively large acreages (hundreds of acres).

3) Influence of Fire

Across most of western Montana and the SRSF, fire has been uncharacteristically infrequent during the past 50 years due to modern suppression activities. However, cool, moist habitat types make up a high proportion of the SRSF, and fire regimes in these types are predominantly mixed severity or stand-replacement that would typically occur at intervals greater than 30 years (see Fire History section for detailed discussion). Therefore, the lower-than-characteristic frequency of fire occurrences during the past 50 years on most sites on the SRSF has had lesser effect than in areas characterized by warm, dry habitats, such as those, for example, found in the Bitterroot Valley. Nonetheless, fire-associated species such as the black-backed woodpecker (*Picoides arcticus*) are probably less abundant on the SRSF currently than would typically have been expected under natural fire regimes, and species preferring dense coniferous ingrowth of shade tolerant tree species (such as Englemann spruce and subalpine fir) under mature forest canopy have likely benefitted. Shrub amounts and distribution important for many non-game species, as well as big game, have also been influenced by fire suppression activities during the past half-

century. However, current departures from average historic conditions are unclear because past logging has created favorable conditions for shrub growth in some instances.

4) Stand Age Characteristics

Based on the analysis in the Vegetation section, over-abundances of old growth occur in the Douglas-fir, white pine, mixed conifer (includes stands dominated by western red cedar) and subalpine fir cover types, while shortages occur in ponderosa pine, western larch/Douglas-fir, and lodgepole pine (comparison of Tables 3-4 and 3-10). These differences are attributable to differential selection of cover types that were harvested, cover type conversions due to fire exclusion and forest succession, and a minor degree of classification and sampling error. Wildlife species that are typically associated with old growth in the cover types that are over-represented have presumably done well, while those that are associated with under-represented types have likely suffered. Although the percentage of the area occupied by old growth overall on the SRSF is presently greater than what would have been expected with long-term average conditions (comparison of Tables 3-4 and 3-10), function may be compromised for some species due to reductions of old growth in some cover types, and overall reductions in average patch size, patch shape and loss of connectivity.

Old growth mixed-conifer stands dominated by western red cedar are found in sections 1-4 (T24N, R17W). Relatively large patches (several hundred acres) of such forest exists in the South Lost drainage. These stands likely provide habitat for associated species such as the brown creeper (*Certhia americana*) and the winter wren (*Troglodytes troglodytes*).

5) Patch Characteristics

Species that are hesitant to cross broad expanses without forest cover or those that depend upon interior forest conditions can be sensitive to the amount and spatial configuration of appropriate habitat. Therefore, patch size and juxtaposition can influence habitat quality and population dynamics for some species. Some species are adapted to thrive near patch edges, while others are adversely affected by the presence of edge or by the presence of other animals that prosper in edge habitats. Patch shape is correlated with how much edge a patch has, given its area. For the purpose of this assessment, a "patch" is defined as a unit of habitat with broadly similar age and structural characteristics (primarily associated with forest or non forest cover). Forested "patches" were considered to be stands or amalgamations of stands that met the minimum definition of — pole-sized or greater with >40% overstory canopy closure.

While there is some question regarding procedures used to estimate stand size in the 1930's inventory (see Patch characteristics discussion), these data generally support that patch size in old growth stands on the SRSF and the project area are smaller than those observed in the 1930s (Tables 3-8 thru 3-13). Interestingly, patch shapes across the SRSF and on the project area have remained relatively similar or have become less complex in recent times. One notable exception, however, is that patch shape for the old growth age class is currently more complex than it was during the 1930s. As a result, habitat conditions within older-aged forests are presently influenced by greater amounts of edge habitat per unit area than would have been expected historically. The actual effects on species of greater existing edge found within greater existing amounts of old growth on the SRSF are unknown.

Connectivity of forest cover between adjacent patches is important for promoting movements of species that are hesitant to cross broad, non-forested expanses. Stands that are pole-sized or greater with crown closure greater than 40% can be important for providing travel cover for species such as fisher and lynx. Across the SRSF, some connectivity through stands of various ages and shapes exists. However, the checkerboard ownership pattern and past management have compromised connectivity to a degree due to harvest unit design and road system development. In the South Lost project area, substantial amounts of travel cover exist that would maintain north-south movement capability across ridges, valleys and saddles from the North Lost drainage to the Cilly Creek drainage. Sizable amounts of continuous travel cover also remain along the foothills at the west end of the South Lost drainage on DNRC ownership (in section 4, T24N, R17W). Well-developed cover extends along the majority of South Lost Creek. However, naturally-occurring cover becomes sparse near the headwaters where forests are dominated by open-grown subalpine fir and white-bark pine that provide little overhead cover. Road #680 that lies along the north side of South Lost Creek and other secondary closed roads provide breaks in otherwise continuous cover that currently exist in the South Lost Drainage, and may impede movements of some species. See the Lynx and Fisher analyses for additional detail on connectivity and travel cover.

6) Special Habitats

There are several areas within the South Lost project area that possess unique habitat value.

a) Rock outcrops and cliff features in sections 1 and 2 (T24N, R17W). These areas may provide habitat for birds such as the white-throated swift (*Aeronautes saxatalis*), rock wren (*Salpinctes obsoletus*), and small mammals such as bushy-tailed wood rats (*Neotoma cinerea*) and golden-mantled ground squirrels (*Spermophilus lateralis*).

b) Avalanche chutes and subalpine meadows located in section 1 (T24N, R17W). These features have spring and summer value for grizzly bears (*Ursus arctos*), Rocky Mountain elk (*Cervus elaphus*) and mountain goats (*Oreamnos americanus*).

c) Riparian vegetation communities associated with South Lost Creek in sections 1-4 (T24N, R17W). These areas are likely important foraging and travel areas for grizzly bears and fisher (*Martes pennanti*). Riparian communities offer some of the richest seasonal, as well as season-long habitats for many species of wildlife. In western Montana, 59% of land birds use riparian habitats for breeding, and of those, 36% breed only in riparian areas (Mosconi and Hutto 1982).

B. *FINE FILTER ASSESSMENT*

The following is an analysis for individual species and habitats that are known to be sensitive to various forms of habitat alteration and/or human-caused disturbance. These species include those federally listed as threatened or endangered, species considered sensitive by DNRC, and big game species managed by DFWP.

1) Threatened and Endangered Species

Four terrestrial vertebrate species are Federally listed as threatened or endangered in western Montana. These include the grizzly bear, gray wolf, bald eagle, and peregrine falcon.

a) Grizzly Bear (Ursus arctos)

The grizzly bear is currently classified as threatened under the Endangered Species Act. In 1995, the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA) was signed by DNRC, the Flathead National Forest, Plum Creek Timber Company, and the U.S. Fish and Wildlife Service. The agreement establishes grizzly bear habitat management standards and guidelines for the Swan Valley Conservation Area (USFWS 1995b, 1995c). The DNRC State Forest Land Management Plan (DNRC 1996) specifies that projects on the Swan River State Forest shall be managed in compliance with the SVGBCA.

i) Analysis Area

The Swan Valley Conservation Area is within the Northern Continental Divide Ecosystem (NCDE) Grizzly Bear Recovery Area. The NCDE comprises 23 Bear Management Units (BMU) (USFWS 1993). Each BMU is further divided into subunits, each of which covers approximately 50 square miles. The proposed South Fork Lost Creek timber sale project area is within the South Fork Lost Soup Subunit of the Bunker Creek BMU (Figure 3-9). The South Fork Lost Soup Subunit encompasses 29,923 acres (46.8 square miles) in the drainages of the South Fork of Lost Creek, Cilly Creek and Soup Creek. DNRC manages 62 percent (18,446 acres) of the subunit, the Flathead National Forest administers 36 percent, and Plum Creek owns approximately 1 percent. Other private landowners own about 1 percent of the subunit.

ii) Analysis Methods and Existing Environment

Hiding cover is one of two variables for which the SVGBCA has defined a standard for all subunits. SVGBCA specifies that each party would "manage their lands so that a minimum of 40 percent of all land in each BMU Subunit in the Conservation Area is maintained in cover." Estimates from stand level inventory data and aerial photo interpretation show that approximately 79 percent of the entire South Fork Lost Soup BMU Subunit and 79 percent of DNRC land within this subunit provide grizzly bear hiding cover.

Open road density is the second habitat attribute for which the SVGBCA has specified a threshold to be calculated for every subunit. It states that "the Parties will manage roads throughout the Conservation Area so that no more than 33 percent of any given BMU Subunit exceeds an open road density of one mile per square mile during the Restricted Period" (to be accomplished by December, 2000). The Restricted Period, April 1 through November 15, approximates the time during which grizzly bears are out of their dens and roaming at large. Open road densities are calculated using a "moving windows" technique (Ake 1995). For this analysis, ERDAS, Version 8.2 (ERDAS 1996) was used to calculate road densities and areas meeting core area criteria. Currently, 28 percent of the South Fork Lost Soup Subunit exceeds an open road density of 1.0 miles per square mile. For the DNRC portion of the subunit, 35 percent exceeds an open road density of 1.0 mile per square mile.

Although SVGBCA does not contain a total road density standard applicable to DNRC and Plum Creek, road density is to be monitored to assist the Flathead National Forest in meeting its standards. Currently, 31 percent of the South Fork Lost Soup Subunit exceeds a total road density of 2.0 miles per square mile.

SVGBCA also establishes guidelines on timing and other conditions for harvest operations within cutting units, and Specially Designated Habitats in the Conservation Area. Specially Designated Habitats include "Linkage Zones," "Low-Elevation Linkage Zones," "Preferred

Habitats," "Riparian Zones," and "Core Areas."

The U.S. Fish and Wildlife Service has delineated four Linkage Zones in the Conservation Area (Servheen and Sandstrom 1993). Approximately 251 acres of the project area (in Sections 13 and 24) are within the Swan River State Forest Linkage Zone (USFWS 1995b Attach. E). None of the project area is within the low elevation portion of this linkage zone (USFWS 1995b: Attach. H1).

Preferred Habitats are designated habitats adjacent to streams and wetlands inside Linkage Zones (USFWS 1995b: Attach. G). No Preferred Habitats are designated in the project area.

Riparian Zones are Streamside Management Zones as defined in the Montana Streamside Management Zone (SMZ) rules (1993). Riparian Zones occur within the project area and are delineated in Attachment F of the SVGBCA. Additional Riparian Zones may be identified during on-the-ground layout of a timber sale. The SVGBCA specifies that only uneven-aged forest management practices shall occur in Riparian Zones in the Swan Conservation Area.

Core areas are free of motorized access during the non-denning period (IGBC 1994). Core areas are at least 2,500 acres in size and a minimum of 0.3 miles from open and restricted roads, motorized trails, and non-motorized trails that receive high intensity use. Thirty-eight percent of the South Fork Lost Soup BMU Subunit meets core area criteria; 26 percent of DNRC land in the subunit meets the spatial definition of core area.

b) *Gray Wolf (Canis lupus)*

Currently, the gray wolf is classified as endangered under the Endangered Species Act. At present, no wolves are known to occur in the Swan valley. However, wolves are increasing in numbers and distribution by natural recolonization in western Montana. The proximity of the Swan valley to existing wolf packs makes it a plausible locale for colonization by dispersing wolves. While the similarity of the Swan valley to areas already occupied by wolves suggests that it could support them, the steep broken topography and low prey density make the project area relatively low quality wolf habitat.

c) *Bald Eagle (Haliaeetus leucocephalus)*

The bald eagle at present is classified as threatened under the Endangered Species Act. DNRC is a signatory to the 1994 Montana Bald Eagle Management Guidelines (MBEWG 1994), and is therefore committed to managing for bald eagles as per the Montana Bald Eagle Management Plan of July 1994. Management direction involves identifying and protecting nesting, feeding, perching, roosting, and wintering/migration areas (MBEWG 1991).

The eagle nest nearest the proposed project is 6 miles away on the shore of Swan Lake. The project area is outside the recommended 2.5 mile home-range management radius around the nest. Thus, activities associated with this project would not influence this nesting pair. No documented roost sites are near the project area boundary. The project area also lies about three miles distant from potential nesting habitat along the Swan River. Bald eagles are not known to winter in the project area, and timber harvesting would not be expected to affect migration behavior of eagles.

d) *Peregrine Falcon (Falco peregrinus)*

Presently, the peregrine falcon is classified as threatened in Montana under the

Endangered Species Act. Strategies to protect and recover populations are outlined in the American Peregrine Falcon Recovery Plan (USFWS 1984).

In western Montana, peregrine falcons typically nest on rocky, mountainous cliffs or in river gorges (USFWS 1984). Peregrines feed almost exclusively on birds found in open habitats, such as marshes, estuaries and croplands. No such feeding areas exist within the project area. However, Swan Lake, the Swan River National Wildlife Refuge and the Swan River all lie within about 4-6 miles of cliff habitat found in the project area. Although it is unknown for certain, these areas collectively may possess enough open country and water to provide ample feeding opportunities for a nesting pair of falcons, should a pair choose to nest in the area.

Peregrines have been observed in the Swan Valley vicinity in recent years. However, observed activity was 10 to 15 miles northwest of the project area. No other nesting peregrine falcons are known to currently reside in the Swan Valley.

2) Sensitive Species Not Assessed in Detail

Sensitive species are those known to be sensitive to human disturbance, or have special habitat requirements that may be altered by land management. There is concern that these species may become listed under the Federal Endangered Species Act in the near future if they are not given special consideration when planning land management activities. Because sensitive species usually have specific habitat requirements, consideration of their needs serves as a useful "fine filter" for ensuring that the primary goal of maintaining healthy and diverse forests is met.

The following species are known to occur on, or near lands administered by DNRC's Northwestern Land Office, but neither they nor their habitats occur in the South Fork Lost Creek project area. A brief discussion is provided to explain the rationale for not considering these species further in this analysis.

a) Flammulated Owl (Otus flammeolus)

This small, migratory owl is most often associated with warm ponderosa pine and Douglas-fir cover types and they can not tolerate cold temperatures, however, they tend to prefer cold temperate/semiarid climates (McCallum 1994). Food availability likely plays a strong role in thermoregulation of this species, and areas that are humid and/or hot are typically avoided. Areas that are cool and humid, such as coniferous forests at high elevations, also are avoided. Flammulated owls are opportunistic insectivores that have high site fidelity, and they use cavities for nesting (McCallum 1994). Their apparent preference for habitats with an abundance of ponderosa pine may be due to a greater abundance of lepidopteran species in these types. Also, ponderosa pine may receive preferential use by some primary cavity-nesting species, such as the pileated woodpeckers (*Dryocopus pileatus*), which create habitat for secondary users like flammulated owls.

While ponderosa pine does occur in the project area, it is limited in abundance and distribution. Only one ponderosa pine stand exists on the project area that is >150 years old. This stand occurs in the S1/2 of the NE1/4 of section 4 and occupies about 25 acres. This stand would have limited ability to provide for the needs of a nesting pair of owls. Further, most stands in the South Fork Lost drainage are cool, moist stands that typically grow as dense forests, which are not highly preferred by flammulated owls. Flammulated owls and their habitat are not expected to occur in the project area. Therefore, will not be considered further in this analysis.

b) *Common Loon (Gavia immer)*

Common Loons are heavy-bodied migratory birds that are dependent upon water. Because of their size and feeding requirements, they typically require lakes greater than 25 acres in size (Skaar 1989) that maintain areas with floating vegetation suitable for nesting. No such areas exist within four mile of the project area. Common loons will, therefore, not be considered further in this analysis.

c) *Harlequin Duck (Histrionicus histrionicus)*

The harlequin duck is a species that is considered sensitive to human disturbance and habitat alteration. They use clear, swift rivers and streams that have cobble and boulder substrate in spring and summer. Harlequins migrate in fall and winter along the Pacific Ocean. No streams or rivers exist in the project area that are large enough, or maintain attributes preferred by harlequin ducks. Thus, harlequin ducks will not be considered further in this analysis.

d) *Coeur d' Alene Salamander (Plethodon idahoensis)*

Coeur d' Alene salamanders are small, terrestrial amphibians typically found below 5,000 feet in elevation. They are closely associated with springs and waterfall spray zones near fractured bedrock, which provide protection from drying and freezing. They may also be found near cascading creeks with dense overhead cover where cool, moist microclimates are maintained (Reichel and Flath 1995). To date, the Coeur d' Alene salamander has been documented in Montana from Lincoln and Mineral Counties only and the SRSF is considered to be outside of its current distribution. Several sites along South Fork Lost Creek and its feeder tributaries possess attributes considered important for Coeur d' Alene salamanders. No harvest activities would occur within at least 165 feet of these sites and habitat features and forest canopy would not be altered. Should Coeur d' Alene salamanders occur within the project area, they would not be influenced by activities related to this project. Coeur d' Alene salamanders will not be considered further in this analysis.

e) *Northern Bog Lemming (Synaptomys borealis)*

Northern bog lemmings are a little-known, rare species that has been found closely associated with sphagnum bogs and fens containing thick moss mats. They have also occasionally been found in wet alpine meadows. Sites where bog lemmings have been captured have generally been found to have open character with little overhead forest canopy. Most of these sites have had shrubs (e.g., *Betula* spp. and *Salix* spp.), and some maintain up to 40% canopy coverage of spruce and/or subalpine fir (Reichel and Beckstrom 1993). To date the northern bog lemming has been documented in Montana from a limited number of sites, including Glacier National Park, Kootenai National Forest, Lolo National Forest, Lewis and Clark National Forest, and northern Beaverhead County. There are currently no known bog lemming observations from state trust land. Intensive surveys were conducted at two locations on the SRSF, but bog lemmings were not detected (Reichel and Beckstrom 1994). Wet sites within the project area are typically steep, well-drained areas that do not support sphagnum bogs or wet meadows. No sphagnum bogs or fens containing thick moss mats, or wet alpine meadows considered suitable for northern bog lemmings were located in the project area. Affects to bog lemmings would not be anticipated as a result of activities associated with this project. Northern bog lemmings will not be considered further in this analysis.

f) Ferruginous Hawk (Buteo regalis)

Ferruginous hawks are associated with open-country habitats such as prairies, plains, badlands, and sagebrush, saltbush-greasewood shrubland. These habitats do not occur within the project area. Thus, this project would not affect ferruginous hawks, and they will not be considered further in this analysis.

g) Columbian Sharp-Tailed Grouse (Tympanuchus phasianellus columbianus)

Columbian sharp-tailed grouse are a subspecies of the more common sharp-tailed grouse found east of the Continental Divide in Montana. This grouse is found in mosaics of grassland, cropland and shrubland. Habitat usable by Columbian sharp-tailed grouse does not occur within the project area. Therefore, they will not be analyzed further in this document.

h) Mountain Plover (Charadrius montanus)

Mountain plover occupy dry, shortgrass prairie and sagebrush habitats, often on high plains. Few observations of mountain plover have been recorded for northwest Montana (Skaar 1996). Habitats known to be usable by mountain plover do not occur within the project area. Thus, mountain plover will not be analyzed further in this document.

i) Townsend's Big-Eared Bat (Plecotus townsendii)

Townsend's big-eared bat is widely distributed, but often occurs at low densities. They are sensitive to disturbance and recover slowly following population declines. In western Montana, Townsend's big-eared bats commonly roost in cavernous habitats and rocky outcrops of sedimentary or limestone origin. Large diameter hollow trees or snags, such as those found in old-growth forests, may also be used for roosting. Colonies of females with young have been found in warm areas of caves, mines, and occasionally buildings. We are unaware of any documented use of the project area by Townsend's big-eared bats, and no caves or abandoned mines used for hibernating sites are known to occur within the project area. However, use of crevices that exist within large rocky outcrops found in sections 1, 2, and 3 is possible.

Being sensitive to disturbance, Townsend's big-eared bats may permanently abandon hibernating and roosting sites if distressed. Appropriate mitigations, other than the retention of snags and snag recruitment trees, primarily involve deferral of activities near sites used by bats and avoiding the creation of additional disturbances.

Retention of large snags would be required under all action alternatives, and patches of unharvested mature and old growth forest several hundred acres in size would be retained in the drainage following any of the proposed treatments. Thus, we expect that long-term habitat capability for this species would not be substantially altered should an action alternative be selected, however, some individual roosting sites could be lost through logging of proposed harvest units.

To further promote conservation of this species, contracts would be written for any action alternative that would specify that if any large aggregations of bats are discovered during preparation or administration of the sale, the DNRC Forest Management Bureau Wildlife Biologist would be informed as soon as possible. The biologist would coordinate efforts to determine the species encountered. Should a concentration of Townsend's big-eared bats be located, further mitigative measures involving minimization of disturbance would be developed as appropriate.

3) Sensitive Species Considered Throughout the Analysis

These sensitive species are considered to occur on or near the project area, or have habitats that are represented within the South Fork Lost Creek watershed. They are, therefore, considered throughout the project analysis.

a) Black-Backed Woodpecker (Picoides arcticus)

Black-backed woodpeckers are closely associated with standing dead forests, created by large fires of high intensity (Hutto 1995). Burned forests tend to be used most soon after burns occur (~2-5 years), and large, densely-stocked stands with an abundance of large trees of various species appear to provide greatest benefit to black-backed woodpeckers (Heijl 1998, unpubl. paper). Black-backs are also found in green forests with high levels of insect activity (Goggans et al. 1989), but appear to occur there at much lower densities (S. Heijl, USFS, Int. Res. Sta., pers. comm. Nov. 1998). Such habitats currently do not exist in the project area. However, stands within the project were disturbed historically by high severity, stand-replacement fire events (Barrett 1996), which would have historically provided quality habitat for black-backs at periodic intervals. Because of this, a large portion of the project area represents potential habitat for this species, should intense fire events occur in this drainage.

Defining specific and appropriate analysis areas is difficult because it is impossible to predict exactly when and where, and at what intensity fire events will occur on a landscape in the future. Therefore, for this analysis, effects on potential black-backed woodpecker habitat will be examined in the context of the project area (Figure 1-2).

b) Boreal Owl (Aegolius funereus)

Boreal owls in Montana occupy mature to old growth forests at elevations from about 5,000 to 8,000 feet, but use of cool, moist microsites down to 4,200 feet has been observed (Hayward et al. 1987). Breeding territories in the northern Rocky Mountains typically occur in subalpine fir habitat types (Hayward et al. 1993). Boreal owls use cavities for nesting, and they rely on pileated woodpeckers (*Dryocopus pileatus*) and common flickers (*Colaptes auratus*) to excavate the holes they use. The presence of seral tree species such as aspen, western larch and occasionally ponderosa pine found at mid to high elevations can provide important raw materials for current and future cavity habitat for boreals (G.D. Hayward, Univ. of Wyo., pers. comm. April 1996). In Idaho, nest sites occurred in more complex forest with higher basal area, more large trees, and less understory development than available sites. However, forest structure immediately around nest trees had an open appearance (Hayward et al. 1993). The density of trees at nests was three times lower than that observed at winter roost sites. While boreals appear to select particular forest structures for nesting, the range of sites used is quite broad. An abundance of snags greater than 15 inches dbh is also likely an important attribute of potential nesting sites (Hayward 1994).

Foraging in winter and summer occurs primarily in more dense, older forests with little herbaceous cover. Their diet is made up almost entirely of small mammals, and red-backed voles (*Clethrionomys gapperi*) are their dominant prey. Boreals also use non-forested openings and meadows for foraging in spring before dense ground vegetation develops (Hayward 1994). Relatively easy access to prey appears to be as, if not more, important to boreals than total prey abundance. Boreal owls are considered somewhat nomadic, have

relatively large home ranges and will fly several miles between small forested patches (>2 acres) to meet their life history requisites.

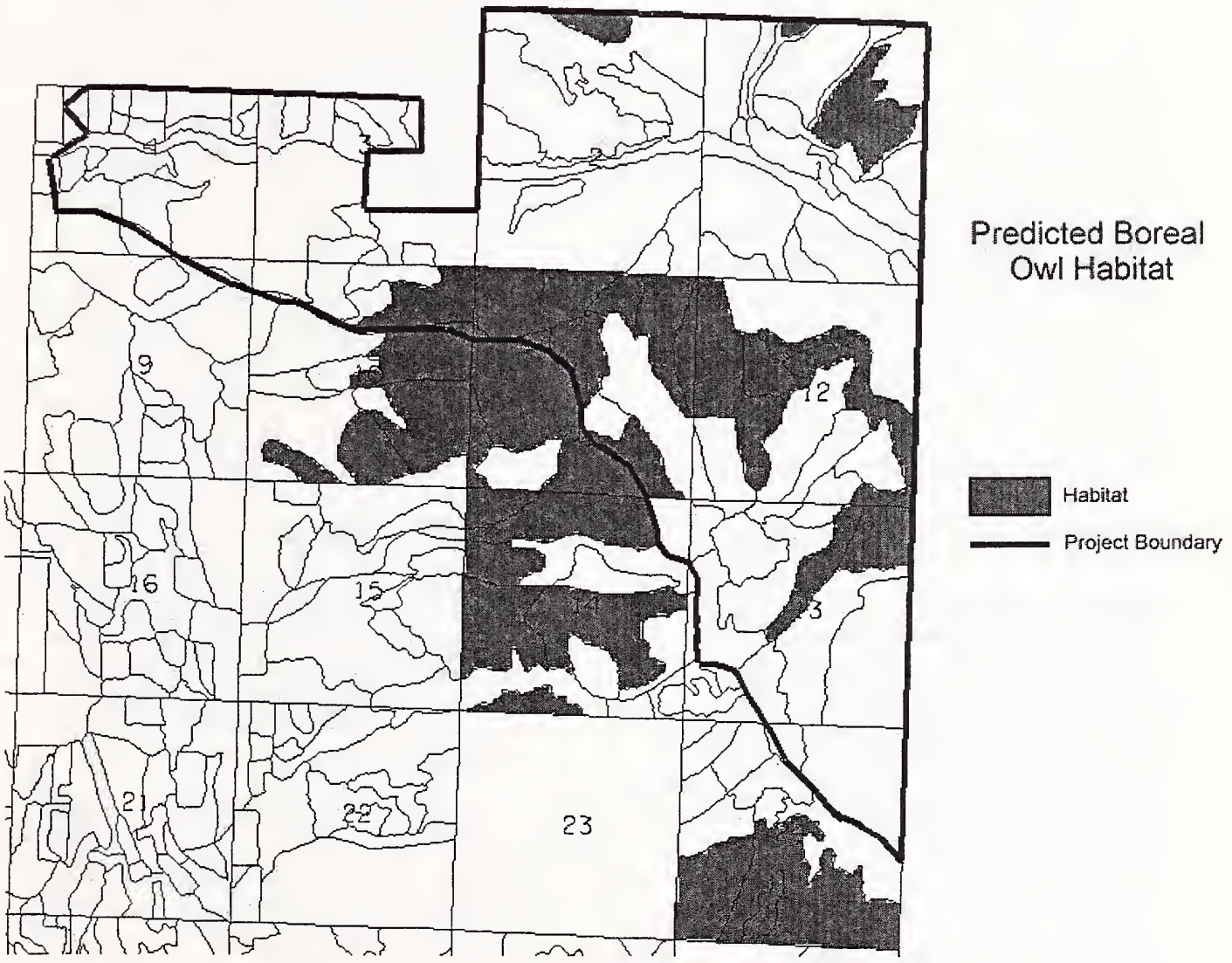
Boreal owls are expected to inhabit the project area.

Acreages of forested habitats deemed important to boreal owls were calculated at two scales: 1) for the SRSF, and 2) for the project area. Because boreals use a variety of habitats at different seasons to meet their requirements for maintenance and reproduction (Hayward 1994), broad analysis criteria were deemed most appropriate for displaying effects to boreal owls. Existing stands of mature sawtimber (stands dominated by trees >9 inches dbh) that occur at elevations >5,200 feet with >40% canopy closure in the mature canopy were considered to represent the broadest habitat category where boreal use would most likely occur. Activities carried out during all seasons (including feeding, roosting and nesting, wintering) could potentially occur within such stands. Because of structural limitations, the lodgepole pine cover type was removed from consideration for this analysis. Because younger sawtimber stands may not provide structural attributes associated with stands of old age (large trees, snags and coarse woody debris), acreage estimates for stands >150 years of age meeting the above criteria (>5,200 ft. with >40% canopy closure) were also reported. Existing acreages that were calculated for these categories are provided in Table 3-24. Figure 3-10 depicts an approximation of stands that meet the above criteria within the project area.

TABLE 3-24. EXISTING ACRES OF POTENTIALLY SUITABLE HABITAT FOR BOREAL OWLS ON THE SRSF AND SOUTH FORK LOST CREEK PROJECT AREA.

Habitat Category	SRSF	Project Area
Acres Mature Sawtimber (100-149 yrs.) with >40% Canopy Closure, Occurring Greater than >5,200 ft. in Elevation	906 (2%)	311 (34%)
Acres Stands >150 years old with >40% Canopy Closure, Occurring Greater than >5,200 ft. in Elevation	2,968 (7%)	491 (17%)
Total	3,874 (10%)	802 (21%)

FIGURE 3-10. PREDICTED BOREAL OWL HABITAT



c) *Fisher (Martes pennanti)*

Fishers are one of the larger locally-occurring members of the weasel family (Mustelidae) that are closely associated with forest environments. Due to the lack of local studies, little is currently known about habitat use by wild fishers in western Montana (K. Foresman, Univ. of Mont., pers. comm. June 1996). From the few existing studies, it is suggested that fishers normally prefer densely-forested, riparian old growth that has an abundance of coarse woody debris and large snags (≥30" dbh) (Powell and Zielinski 1994). They also tend to use forests that exist below 6,000 feet in elevation. Dense overhead canopy cover is important for snow interception as fishers have difficulty traveling in deep fluffy snow (Powell and Zielinski 1994). Fishers forage on carrion, snowshoe hares (*Lepus americanus*), porcupines (*Erethizon dorsatum*), small mammals, and birds. Fisher declines have primarily been attributed recently to habitat loss (ie., reduction and fragmentation of late successional forest caused by logging), and direct population reductions caused by over trapping (Powell and Zielinski 1994). The road along South Fork Lost Creek (road #680) is open to year-round travel (including snow machines). The project area is, therefore, relatively accessible for winter trapping.

Habitats commonly associated with fisher are found within the project area, and fisher (at least seasonally) are expected to occur there.

Average home ranges of male and female fishers have been reported in the literature to be about 15 and 6 square miles respectively (range from about 1.5 to 30 square miles—both sexes) (Powell and Zielinski 1994:58). Therefore, assessing habitat availability at a landscape scale is most appropriate for this species. Current DNRC sensitive species guidance applicable to the SRSF specifies that analyses for this species be conducted for the corresponding Grizzly Bear Management Unit (BMU) (see grizzly bear analysis and Figure 3-9 for additional detail). For this project, habitat availability was examined for the South Fork Lost Soup BMU and the project area. DNRC's sensitive species guidance specifies a goal for habitat retention at the BMU scale. This goal is for 75% of the acreage of Preferred Fisher Cover Types within required riparian buffers to be managed in a mature and/or well-stocked condition (ie., must have ≥ 70% crown canopy).

For this analysis we examined cover variables in two different ways; at the BMU and project area scales to assess effects on fishers. First, for sites below 6,000 feet in elevation, we estimated the amount of well-stocked and moderately stocked sawtimber (stands dominated by trees >9 inches dbh) that presently occurs within buffers of 165 feet (50 meters)on either side of perennial streams, and within 83 feet (25 meters) either side of intermittent streams. Stands quantified in this fashion are presumed to be those most usable by fisher for foraging, resting and denning.

Secondly, to evaluate whether natural features and/or timber harvesting have fragmented cover on the landscape to a point where sufficient connectivity is no longer present to allow for functional home ranges, we mapped all patches within the BMU with >40% crown canopy in pole-sized or greater stands. These areas were considered non-cover. We then buffered these patches by 165 feet (50 meters) along each boundary. Thus, mapped patches of non-cover represented open areas at least 330 feet wide (100 meters) at their narrowest points. Isolated patches of cover within blocks of non-cover were considered as non-cover with respect to their contribution to connectivity of travel cover for fishers. The mapped patches of non-cover were intended to model movement barriers to fishers. The spatial location of non-cover patches was

then assessed with respect to third order drainages. In this assessment, 40% crown canopy was assumed to provide the minimum amount of overhead cover necessary for fisher travel.

Approximately 1,250 of 1,853 acres of potential habitat within riparian buffers (67%) has the needed stocking assumed to provide for fisher denning, foraging and resting within the BMU (Figure 3-11). These amounts currently fall below the 75% goal for cover retention specified in DNRC's Sensitive Species Guidance for fisher. A sizable area in Napa Creek (about 100 acres in the southern portion of BMU) that falls within the analyzed fisher buffer is lacking cover believed important for fisher. The Napa Creek drainage is virtually unroaded and unmanaged, however, much of the area is comprised of natural openings. These natural openings are responsible for the lack of fisher cover in this drainage. Much of the additional lack of fisher cover is due to past management. Within the project area, 254 of preferred fisher habitat occurs within 330 acres of riparian buffer (77%). The map depicting areas of travel cover and non travel cover (Figure 3-12), suggests that although barriers exist that would be expected to limit movements of fishers, none have eliminated routes through which movement could occur across major drainage features found within the BMU. Currently, 12,048 acres (66 %) of the DNRC ownership that met travel cover criteria occur within the BMU.

Comparable stand data for non-DNRC ownership within the BMU and project area were not available or considered in this analysis. Therefore, actual cover and habitat relationships for the BMU and project likely would vary somewhat from those described for DNRC ownership alone. During the analysis it was recognized that the N 1/2 of the SE 1/4 of section 3 (USFS ownership), that falls within the project area, was an important link for maintaining connectivity of travel cover for fishers. From aerial photograph interpretation and cursory field evaluation, this parcel currently maintains cover adequate for meeting the travel cover criteria for fisher. As we know of no current plans by the Flathead National Forest to remove cover on the parcel in the near term (~5 years), we considered it as viable travel cover for the purposes of this analysis.

FIGURE 3-11. PREFERRED FISHER HABITAT

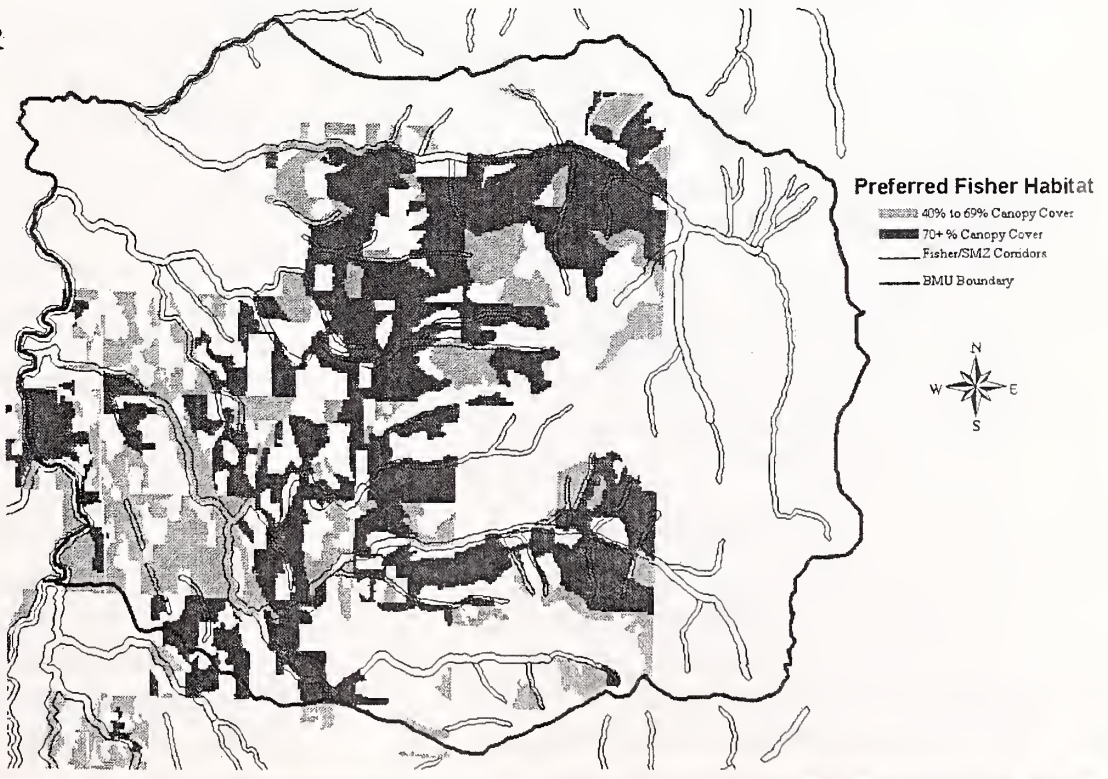
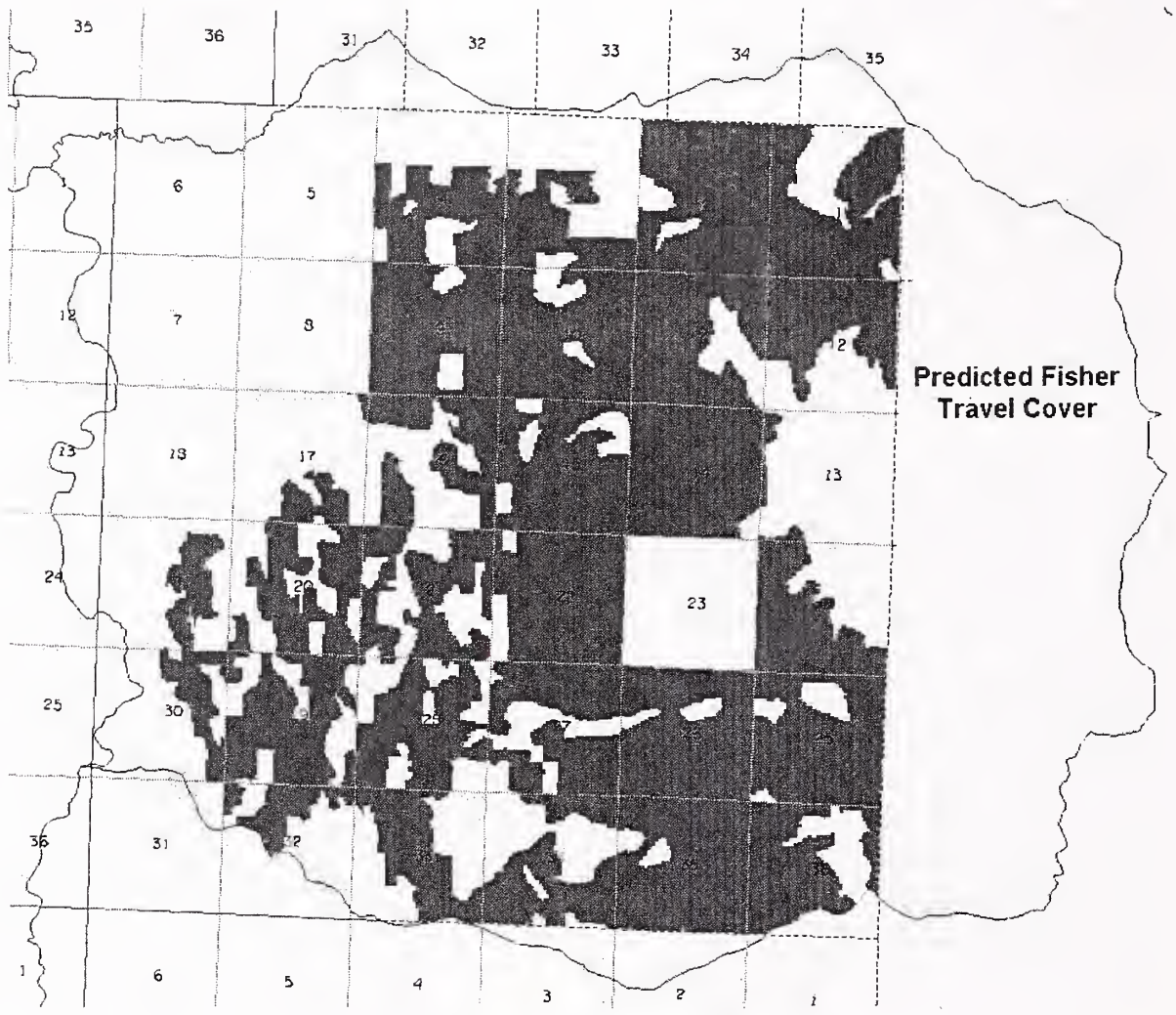


FIGURE 3-12. PREDICTED FISHER TRAVEL COVER



d) Lynx (Lynx canadensis)

The lynx is currently a candidate species for listing under the U.S. Endangered Species Act. It is likely that the lynx will be listed as threatened or endangered in Montana during 1999.

In North America, lynx distribution and numbers are strongly correlated with snowshoe hares; their primary prey. In the western mountains of the United States, lynx populations occur at the periphery of the species' range in North America (Koehler and Aubry 1994). Where lynx occur at lower latitudes, they are associated with higher elevations where environmental conditions are similar to the boreal forests of Canada and Alaska. Lynx populations are known to fluctuate naturally with changes in snowshoe hare density (Brand and Keith 1979). However, forest management activities that fragment cover suitable for travel, thin overstocked conifer regeneration, and reduce old growth denning habitat near foraging areas may be detrimental to lynx. Road construction that improves access for trapping can also have negative consequences for lynx (Koehler and Aubry 1994:89).

Due to the lack of local studies in the past, little is currently known about food habits and habitat preferences of lynx in western Montana (K. Foresman, Univ. of Mont., pers. comm. June 1996). However, a study designed to examine lynx habitat use and movements in the Seeley-Swan Valley is currently being conducted at the USFS Forest Sciences Lab on the University of Montana Campus. At the time this

document was drafted, at least 12 lynx from the Seeley Lake vicinity had been trapped and radio-collared (during the winter of 1998). Their movements are currently being monitored.

From the local studies that are currently available, it is suggested that lynx normally prefer densely-forested old growth that has an abundance of coarse woody debris, root wads and large snags for denning and rearing of kittens (Koehler and Aubry 1994). Denning sites that are located near dense, 10-30 year old conifer stands that contain high numbers of snowshoe hares are beneficial to lynx for foraging. Habitats used most tend to occur at elevations >5,000 ft. in elevation. Although use at lower elevations has been documented during track surveys conducted in the Seeley Lake Area (Mike Thompson, DFWP, pers. comm. 1997). Because lynx tend to avoid areas lacking dense, overhead vegetation, well-connected travel cover at the landscape scale may also be important for maintaining viable populations of lynx (Koehler and Aubry 1994:88).

Lynx are known to occur in the Swan Valley, and older forests potentially suitable as denning habitat and regenerating stands important for foraging both occur in the project area. Young lodgepole stands, frequently cited as supporting high densities of snowshoe hares (Koehler and Aubry 1994) are not found in the project area. Information specific to the quality of lynx habitat on the project area is presently lacking. The road along South Fork Lost Creek (road #680) is open to year-round travel (including snow machines). The project area is, therefore, relatively accessible to trappers in winter.

Because lynx also have relatively large home ranges, we examined cover variables for this analysis in two different ways, and at the BMU and project area scales. First, we mapped all old growth stands (>150 years of age) that were well stocked and maintained high amounts of coarse woody debris. We then displayed all unthinned/well stocked stands of saplings. Stands mapped in this fashion were presumed to be those most usable by lynx for denning and foraging respectively. Well stocked old growth stands supporting high amounts of coarse woody debris that fell within 0.76 miles (2 km)of dense sapling stands were consider to be those areas most likely to be used by lynx for denning (Figure 3-13). DNRC sensitive species guidance for lynx suggests that approximately 30% of a BMU would be desirable to manage in the sapling size class. Efforts to manage for up to 5% of an analysis area in denning habitat near foraging habitat are also deemed desirable.

Secondly, to evaluate whether natural features and/or timber harvesting have fragmented cover on the landscape to a point where sufficient connectivity is no longer present to allow for functional home ranges of lynx, we mapped all patches within the BMU with <40% crown canopy in pole-sized or greater stands. These areas were considered as non-cover. We then buffered these patches by 165 feet (50 meters) along each boundary. Thus, mapped patches of non-cover represented open areas at least 330 feet wide (100 meters) at their narrowest points. Isolated patches of cover within blocks of non-cover were considered as non-cover with respect to their contribution to connectivity of travel cover for fishers. The mapped patches of non-cover were intended to model movement barriers to lynx. The spatial location of non-cover patches was then assessed with respect to third order drainages. The same criteria that were used for estimating fisher travel cover were also used for lynx.

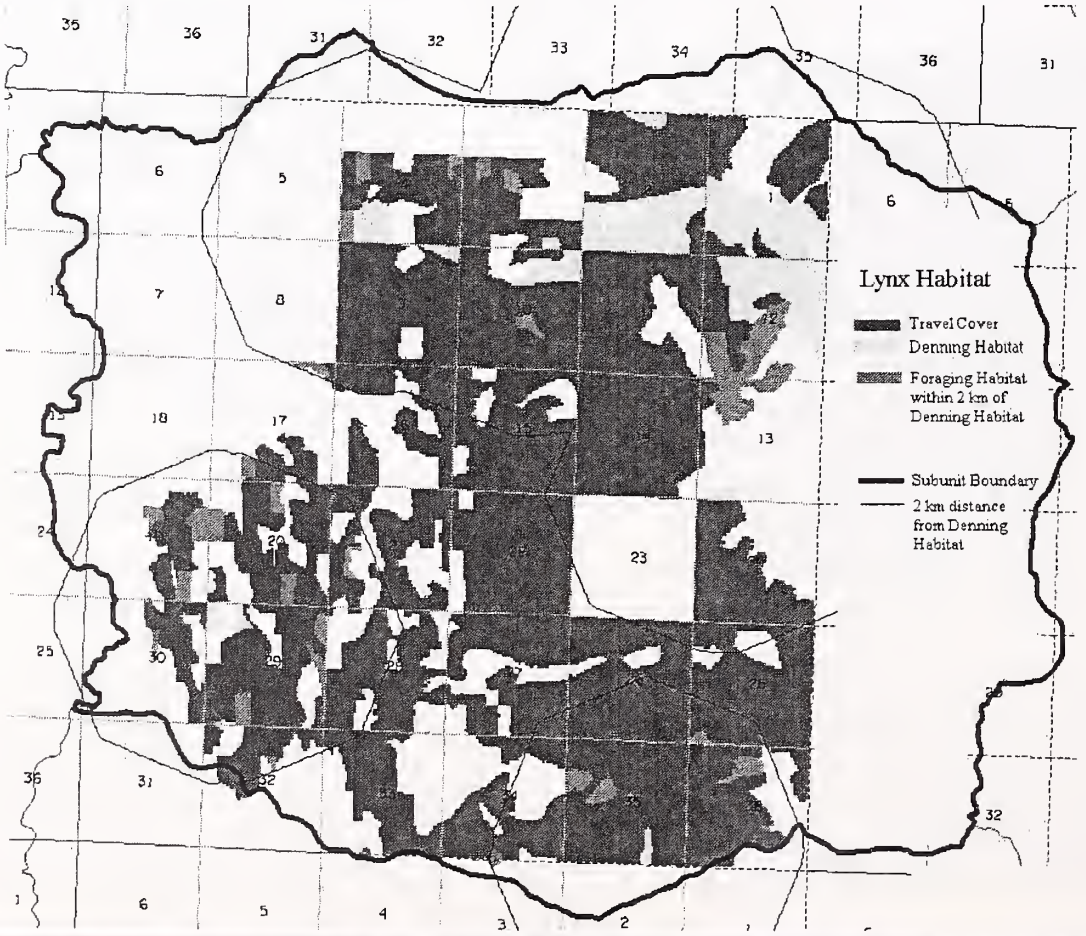
While lynx are known to use young conifer stands with dense overhead cover >6 feet high (Koehler and Aubry 1994), such stands can become unusable where snow is deep. Therefore, pole-sized and larger stands were considered to provide the most

reliable estimators of cover usable for travel across a broad range of environmental conditions. Crown canopy of >40% was also assumed to provide the minimum amount of overhead cover necessary to provide for lynx travel.

Approximately 967 acres of potential denning habitat and 1,093 acres of nearby foraging habitat currently exist in the BMU, while approximately 907 acres of potential denning habitat and 260 acres of nearby foraging habitat currently exist in the project area (Figure 3-13). The amount of existing sapling stands (currently at 1,093 acres, ~6% of DNRC ownership within the BMU) is currently below the approximated goal of ~30% in DNRC's Sensitive Species Guidance for foraging habitat for lynx. Of this, 638 acres are within 0.76 miles (2 km) of potential denning habitat. The map depicting areas of travel cover and non travel cover for lynx (Figure 3-13), suggests that although barriers exist that would be expected to limit movements of lynx, none have completely eliminated routes through which movement could occur.

Comparable stand data for non DNRC ownership within the BMU and project area were not available or considered in this analysis. Therefore, actual cover and habitat relationships for the BMU and project likely would vary somewhat from those described for DNRC ownership alone. During the analysis it was recognized that the N 1/2 of the SE 1/4 of section 3 (USFS ownership), that falls within the project area, was an important link for maintaining connectivity of travel cover for lynx. From aerial photograph interpretation and cursory field evaluation, this parcel currently maintains cover adequate for meeting the travel cover criteria for lynx. As we know of no current plans by the Flathead National Forest to remove cover on the parcel in the near term (~5 years), we considered it as viable travel cover for the purposes of this analysis.

FIGURE 3-13. LYNX HABITAT



e) *Pileated Woodpecker (Dryocopus pileatus)*

Pileated woodpeckers are large birds that excavate sizable cavities, and therefore require large trees and snags (>20 inches dbh and >20 feet tall) with heart-rot for nesting and roosting (typically western larch, ponderosa pine and cottonwood) (McClelland 1979). Coarse woody debris and snags provide important substrates for foraging. Such attributes are typically associated with mature and old forests. Pileated woodpeckers can have home range areas that include forested areas interspersed with non-forested and developed areas, and pileated pairs likely require >500 acres for foraging in habitats found in the Rocky Mountains (McClelland 1979). Forest patches of smaller size are used, especially if situated near other suitable patches.

Pileated woodpeckers are considered an important "keystone" species that provides needed habitat elements for a host of other species. Species that make secondary use of cavities excavated by pileated woodpeckers include, but are not limited to, flammulated (McCallum 1994) and boreal owls (Hayward 1994).

Pileated vocalizations were heard during a field review of the project area on September 24, 1998, and they are likely to forage in, and/or inhabit the project area.

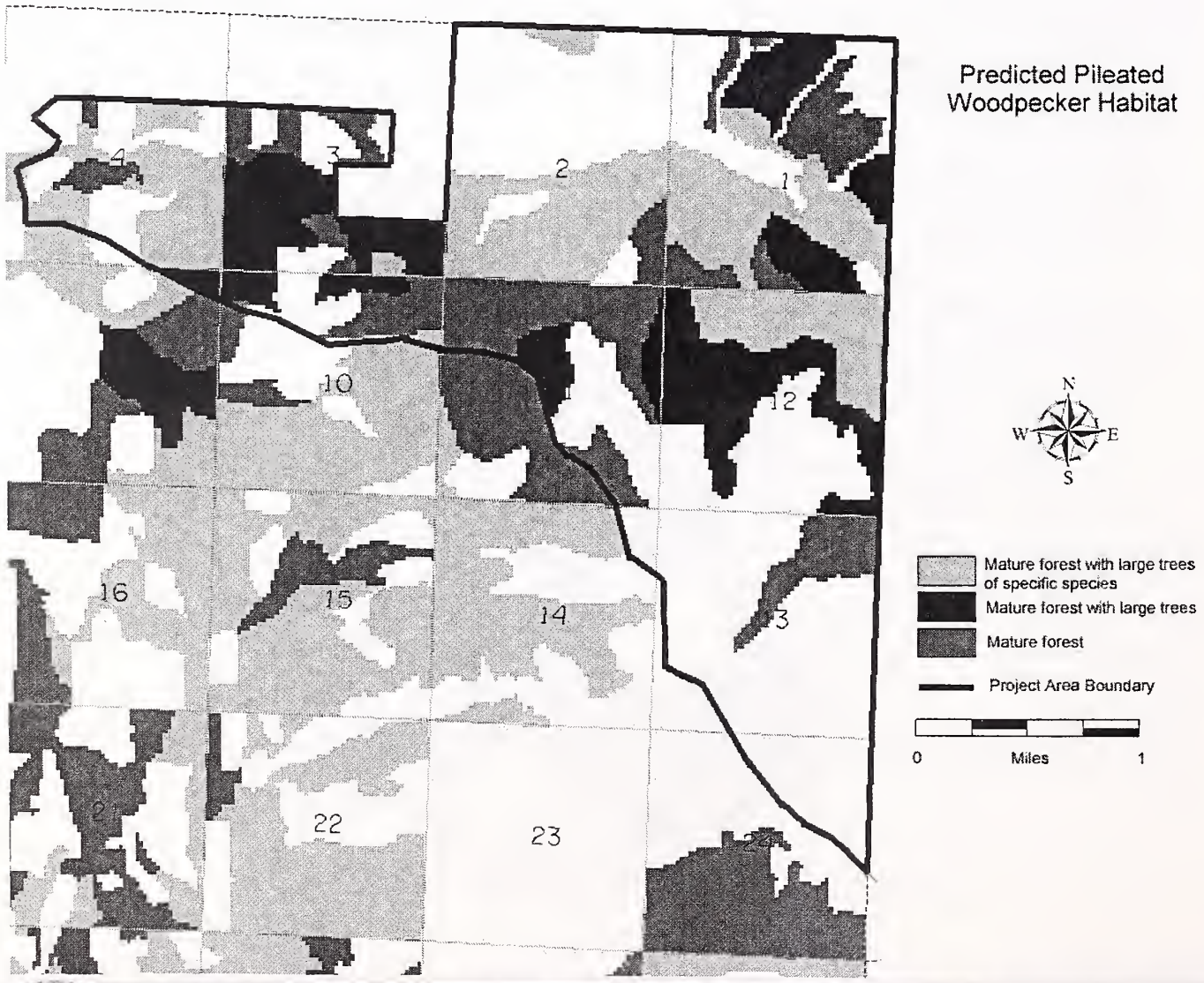
Forest management activities can reduce the abundance of suitable habitat for pileated woodpeckers by removing and fragmenting mature and old growth forest, and/or those attributes associated with mature forests such as snags and coarse woody debris (such as firewood cutting). Illegal removal of firewood is known to occur along road #680 within the project area.

Acreages of forested habitats deemed important to pileated woodpeckers were calculated at two scales: 1) for the SRSF, and 2) for the project area. Because pileated woodpeckers use both mature and old growth forest for meeting their life requisites, analysis of the distribution and abundance of moderate to well stocked forest of these ages was deemed most appropriate for broadly displaying effects to pileated woodpeckers. Because mature sawtimber stands alone may not provide structural attributes associated with stands of old age (large trees, snags and coarse woody debris), acreages and locations for old growth stands (>150 years of age) that maintained an abundance of large trees were also considered. Old growth stands with an abundance of large trees were considered those with a minimum of 11 trees >17 inches dbh per acre, and a minimum of 11 trees >21 inches dbh per acre. Stands assumed to have the greatest potential for nesting were those old growth stands with an abundance of large trees that also possessed at least 10% collectively of ponderosa pine, western larch and/or black cottonwood in the dominant overstory (ie., one out of at least every ten trees had to be either PP, WL or BC). Existing acreages that were calculated for these categories are provided in Table 3-25. Figure 3-14 depicts stands that meet the above criteria within the project area.

TABLE 3-25 EXISTING ACRES OF POTENTIALLY SUITABLE HABITAT FOR PILEATED WOODPECKERS ON THE SRSF AND SOUTH FORK LOST CREEK PROJECT AREA. THE NUMBER IN PARENTHESES REFERS TO THE PERCENTAGE OF THE FOREST IN A HABITAT CATEGORY THAT FALLS WITHIN THE PROJECT AREA.

Habitat Category	SRSF	Project Area
Acres Mature Sawtimber (100-149 yrs.) Moderate to Well-Stocked	4,638	665 (14%)
Acres Old Growth (>150 yrs.) Moderate to Well-Stocked with Abundance of Large Trees	2,023	724 (36%)
Acres Old Growth (>150 yrs.) Moderate to Well-Stocked, with Abundance of Large Trees, and >10% Comp. PP, WL or BC	10,940	910 (8%)
Total	17,601	2,299 (13%)

FIGURE 3-14. PREDICTED PILEATED WOODPECKER HABITAT



4) BIG GAME

Elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*) and white-tailed deer (*O. virginianus*) can be influenced by forest management activities. All three species have cover requirements that vary by type and season, and each species can be influenced by reductions in forest cover. Summer habitat quality for elk can be reduced by increases in access and decreases in cover used for shade and escape, and winter cover can be important for promoting survival of all three species, especially white-tailed deer.

Elk can also be affected during the General Big Game Season in fall by increases in foot and motorized access on roads, and fragmentation of mature forest patches that reduces cover below a threshold that would provide for hiding and security. Timber harvest can increase elk vulnerability by changing the size, structure, juxtaposition and accessibility of areas that provide security during hunting season (Hillis et al. 1991). As visibility and accessability increase within forested landscapes, elk have a greater probability of being observed and subsequently harvested by hunters. Because the cow segment of the harvest is normally regulated carefully, primary concerns are related to substantial reduction of the bull segment and subsequent decrease in hunter opportunity. The presence of fewer mature bulls at the beginning of the hunting season, reduces the odds of any given hunter to see or harvest such an animal throughout the remainder of the season. Because of their smaller size and behavioral differences, mule deer and white-tailed deer are able to use smaller cover patches more effectively for escape and security. Therefore, we assume that if available cover provides for elk, it also is adequate to meet the needs of mule deer and white-tailed deer.

Elk are less dependant upon winter thermal cover than deer. However, in areas that normally receive deep snow in winter, areas with dense overhead cover frequently receive substantial use by elk (Jenkins 1985). Densely stocked thickets of conifer regeneration and overstocked mature stands provide good thermal protection for elk and deer in winter, which can reduce energy expenditures and stress associated with cold temperatures. Areas in the project area with densely stocked mature trees are also important for snow interception, which makes travel and foraging less stressful for elk and deer during periods when snow is deep.

Elk and mule deer are distributed throughout the project area primarily from spring through fall. The project area receives limited non-winter use by white-tailed deer which are more commonly found at lower elevations west of the project area. The DFWP has identified 359 acres of the project area (Sections 2 and 3, north of South Fork Lost Creek) as elk and mule deer winter range. Habitat models developed for elk also are used to assess the existing condition and impacts of proposed activities for mule deer (USFS 1994).

a) Habitat Effectiveness

Effects on habitat effectiveness for elk were analyzed for the 4,162 acre project area for this assessment. The analysis of elk and mule deer habitat during the non-winter period follows a method developed for northern Idaho (Leege 1984). The method assumes that each area has an inherent biological potential to support elk through the non-winter period. Maximum potential is assigned a Habitat Effectiveness coefficient (HE) of 100 percent apriori. The HE coefficient allows assessment of the existing condition and the effects of proposed actions within an analysis area; it does not allow comparisons of different analysis areas. Within an analysis area, reductions in hiding cover, reductions in thermal cover, and increases in the densities of cattle (AUM per square mile) or open roads (miles per square mile) reduce

habitat effectiveness. This procedure does not address site specific habitat components such as moist sites, licks, or wallows.

Previous regeneration harvest areas in the project area are at least 20 years old. These old cutting units provide hiding cover but not summer thermal cover. Approximately 84 percent of the project area provides hiding cover (using criteria established for grizzly bears) and 72 percent provides summer thermal cover. No cattle are present in the project area. Diminution of current habitat effectiveness in the project area is caused by 4.0 existing miles of open road and 5.4 miles of closed road (0.51 standardized miles per square mile of which 5.3 miles goes through non-cover), which reduces the existing HE coefficient to approximately 75 percent of potential elk use for the existing condition.

b) Elk and Mule Deer Winter Range

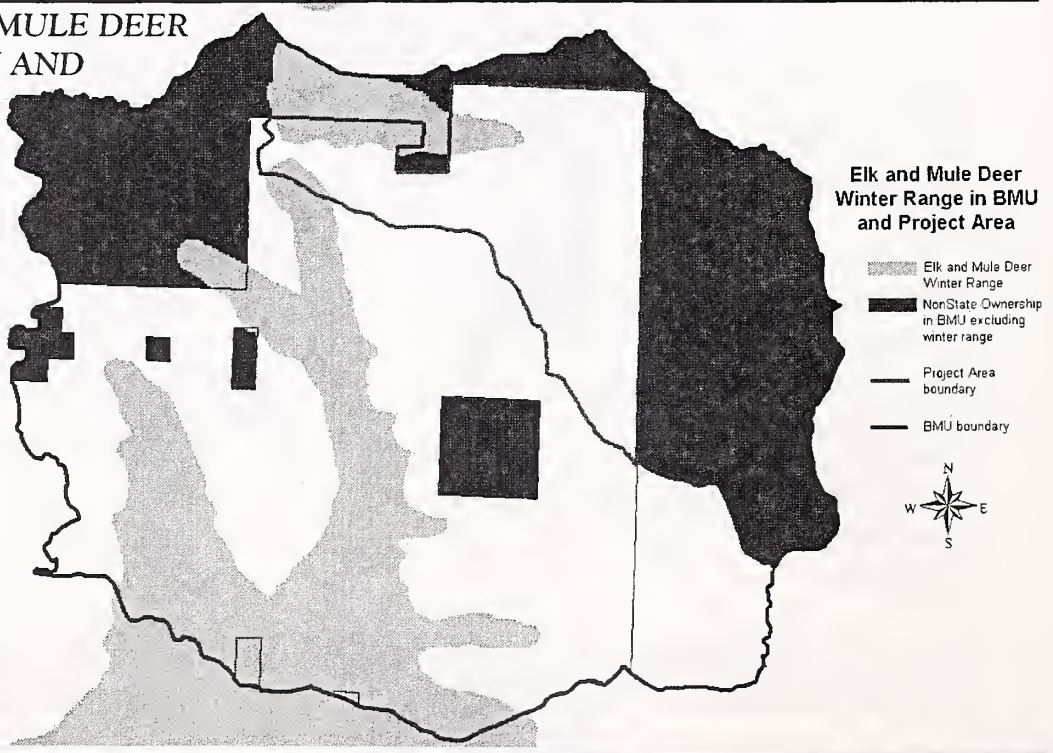
Effects on elk and mule deer winter range (Figure 3-15 - Elk/Mule deer winter range map) were analyzed for the project area for this assessment. Winter thermal cover for elk and mule deer is defined as greater than 50 percent coniferous canopy coverage during the winter (larch does not contribute) at least 20 feet high, preferably in patches of at least 20 acres. Stands that met the definition of thermal cover within the project area overall total about 2,769 acres. However, within the 359 acres of identified winter range in the project area, only about 169 acres would provide winter thermal cover.

c) Elk Security

Existing elk security in the analysis area surrounding the proposed project area was evaluated following the methods of Hillis et al. (1991). Effects on elk security were analyzed for the project area for this assessment.

Elk security habitat is defined as an area of at least 250 acres which, during the autumn (hunting seasons), is at least 0.5 miles from an open road, provides thermal or hiding cover, and is "non-linear" in shape (Hillis et al. 1991). Hillis et al. also recommended that at least 30% of an analysis area be maintained in cover that would qualify as security. Within the project area, 1,489 acres (36 percent of the project area) currently qualify as elk security habitat.

FIGURE 3-15. ELK AND MULE DEER WINTER RANGE IN BMU AND PROJECT AREA.



VI. WATERSHED

The entire project area lies within the South Fork of Lost Creek watershed. The South Fork of Lost Creek is a perennial tributary to the Swan River and drains 11,164 acres, which includes the Cliff Creek drainage (Figure 3-9). Annual precipitation in the watershed ranges from 25 inches where the creek meets Swan River to 70 plus inches on the upper ridges and headwater reaches. The upper watershed consists of very steep, rocky valley sideslopes, cliffs, and high gradient high energy streams. The South Fork of Lost Creek and Cliff Creek flow year-round. Numerous small tributaries to these reaches flow seasonally during runoff from snowmelt and rainstorms. Some small tributaries, particularly those in the avalanche chutes, flow year-round.

A. *WATER QUALITY*

Timber harvest and related activities, such as road construction, can lead to water quality impacts by increasing production and delivery of fine sediments to streams. Harvesting trees can lead to increases in water yields, which in turn can increase stream channel and bank erosion. Construction of roads, skid trails and landings generates and transfers substantial amounts of sediment through removal of vegetation and exposure of bare soil. Removal of vegetation near stream channels reduces sediment filtering capacity in these areas, and may reduce channel stability and amounts of large woody material in the channel. Large woody debris in the channel is an important component of stream dynamics, creating natural sediment traps and energy dissipators to reduce the velocity and erosiveness of stream flows.

1. Water Quality Standards

This portion of the Swan River drainage, including the South Fork of Lost Creek and Cliff Creek, is classified B-1 by the Montana Surface Water Quality Standards. Among other criteria for B-1 waters, no increases are allowed above naturally occurring levels of sediment, and minimal increases over natural turbidity. "Naturally occurring" includes conditions or materials present during runoff from developed land where all reasonable land, soil and water conservation practices (commonly called Best Management Practices or BMP) have been applied. Reasonable practices include methods, measures or practices that protect present and reasonably anticipated beneficial uses. These practices include but are not limited to structural and non-structural controls and operation and maintenance procedures. Appropriate practices may be applied before; during, or after completion of activities.

Designated beneficial water uses within the project area include aquatic life, cold water fisheries, and recreational use on the South Fork of Lost Creek and its tributaries. The South Fork of Lost Creek is not currently on the list of Water Quality Limited Waterbodies (303 [d] list), maintained by the Montana Department of Environmental Quality.

2. Current Water Quality Conditions

The primary impact to water quality in the South Fork of Lost Creek is related to numerous major avalanche chutes. These can carry large amounts of sediment and large woody debris to the creek. The woody material deposited in the creek has created numerous debris jams throughout the stream course, some of which are stable and some that are not. The unstable jams present a high potential for a large flush of sediment should they fail during high runoff. The South Fork Lost Creek road also is a sediment source to the creek in some of its lower reaches where it is located within the Streamside Management Zone (SMZ). Other roads within the watershed range from low to moderate standard, some of which do not currently meet BMP. A detailed source survey of

both in-channel and road-related sources of sediment was conducted for the entire South Fork of Lost Creek watershed. Road-related sediment sources are listed in the project file.

Other potential or existing sources of sediment include three bridges across the South Fork of Lost Creek. One present source of sediment is a failed bridge located in section three on Forest Service ownership. The structure is wooden with back filled wooden abutments. This bridge has been overtopped by stream flow numerous times in the past decade or so. The fill behind the abutments has begun to erode on the south side of the creek, and all of the decking has come off. This bridge will continue to contribute sediment to the South Fork of Lost Creek on a nearly annual basis during high runoff until it is either washed out completely or removed and the site rehabilitated.

The other two decaying bridges are potential sources of sediment located in Sections 2 and 4 on State land. These bridges were built at the same time as the bridge on Forest Service land but were built with more freeboard, so they have not been overtopped. The construction is the same as the failed bridge, and the fill around the abutments is in danger of erosion during higher than normal runoff. These bridges present a moderate risk of failure and sedimentation to the creek.

B. *CUMULATIVE WATERSHED EFFECTS*

Cumulative watershed impacts are defined as impacts that may result from the proposed action when combined with other past and present actions. Individually, these actions may not adversely affect water quality, but when combined present a higher risk of adverse impacts. Timber harvest and associated activities affect the timing, distribution, and amount of water yield in a watershed. Water yields increase in proportion to the percentage of canopy removal because removal of live trees reduces the amount of water transpired, leaving more water available for soil saturation and runoff. Canopy removal also decreases interception of rain and snow, and alters snowpack distribution and snowmelt, which lead to further water yield increases. Higher water yields may lead to increases in peak flows and peak flow duration, which result in accelerated streambank erosion and subsequent deposition of fine sediment.

1. Current Conditions

Land use history within the proposed project area includes commercial timber harvest and recreation activities. DNRC has conducted timber sales in the South Fork Lost Creek watershed since 1962. The Flathead National Forest (FNF) also harvested some of its land within the South Fork of Lost Creek watershed beginning in the 1950s, and has harvested as recently as 1982. Avalanches have removed the mature forest vegetation on several hundred acres in the project area. Although new forest growth is occurring in these areas, the avalanche chutes probably would never become fully forested due to recurring avalanches.

A DNRC hydrologist gathered channel stability data in 1995 in accordance with procedures outlined in Forest Hydrology Part II (Haupt et al. 1974). Stream bank stability ranged from fair to good on all reaches reviewed. Most areas of instability were a result of debris jams caused by avalanches. Avalanches carry large amounts of sediment and very high levels of large woody debris to the creek. These jams lead to instability and sediment delivery because they can accumulate relatively small diameter material which can be detached by high runoff. The other reaches where channel stability was rated as fair were due to the South Fork Lost Creek road encroaching on the banks and riparian area of the creek. These channel stability assessments are used to determine the stream's capacity to handle increases in

annual runoff, in accordance with procedures outlined in Forest Hydrology Part II (Haupt et al. 1974).

DNRC's hydrologist estimated that channel stability and water quality in the South Fork of Lost Creek might begin to be adversely affected if water yield were to increase 10 percent above the projected baseline. This "threshold of concern" was arrived at through analysis of the channel stability assessments, adherence to the guidelines for watershed management in the Swan River State Forest Management Plan (1978), and direction from the SFLMP to manage at low risk for watershed impacts in all tributaries to the Swan River.

2. Methodology

The cumulative effects of past activities in the South Fork of Lost Creek watershed were determined using the PC version of the R1WATSED model developed by Region 1 of the U.S. Forest Service. WATSED estimates the increase in water yield caused by removal of live trees using the Equivalent Clearcut Area (ECA) method. ECA is a function of total area roaded and harvested, percent crown removal in harvest, and amount of vegetative recovery that has occurred in harvest areas. This method equates area harvested and percent crown removed with an equivalent amount of clearcut area. For example, if 100 acres had 60 percent crown removed, ECA would be approximately 60, or equivalent to a 60-acre clearcut area. As live trees are removed, the water they would have evaporated and transpired either saturates the soil, or is translated to runoff. This method also calculates the recovery of these increases as new trees vegetate the site and move toward pre-harvest water use. WATSED also estimates sediment production from road and timber harvest activities. Estimates of sediment production by activities are expressed as a percentage above an estimated "natural" baseline condition generated by the model based on soil types and watershed size. Since the natural conditions are calculated on the basis of empirical formulas and not on site specific measured data, sediment values generated by the model are only valid as a comparison between alternatives and should not be interpreted as absolute values.

3. Results

According to WATSED, the present annual water yield increase is 1 percent over natural, the peak flow increase is 1 percent over natural, and past timber harvesting has generated approximately 325 ECA. The allowable threshold for ECA for the project area is 3,939 ECA. Table 3-26 describes current conditions for the South Fork Lost Creek project area using WATSED.

TABLE 3-26. WATSED PREDICTED WATERSHED EFFECTS FOR SOUTH FORK LOST CREEK EXISTING WATERSHED EFFECTS

Existing Watershed Effects	
Acres Harvested	---
Miles of New Road	---
ECA Generated	---
Total ECA[1]	325
Allowable ECA	3,939
% Increase Over Natural Runoff 2	1%
Allowable Increase Over Baseline Runoff	10%

[1] *All values are based on projection year 1998*

[2] *Natural condition was determined by WATSED using empirical formulas, and are not based on measured values on the ground. Use values only as a comparison among alternatives.*

VII. FISHERIES

Westslope cutthroat trout and bull trout are species of special concern found in limited numbers and habitats in Montana. The Montana Department of Fish, Wildlife and Parks (DFWP) manages the Swan Drainage for the native westslope cutthroat trout and bull trout. In order to meet the recommendations for these species from the Flathead Basin Forest Practices, Water Quality and Fisheries Cooperative Program (the cooperative study report of the Flathead Basin Commission 1991), DNRC has contracted DFWP and arranged for the collection efforts required to develop index values of existing habitat quality as recommended. The DNRC/DFWP strategy is to first develop the index of juvenile bull trout rearing habitat quality using substrate scoring and McNeil coring as described in the cooperative study report. Based on the results from substrate scoring, DNRC in consultation with DFWP would determine if additional monitoring is necessary.

A. *SWAN RIVER*

Bull trout and migratory westslope cutthroat trout inhabit Swan Lake and Swan River, and use small Swan River tributaries for spawning and rearing of juveniles. Because of this migratory behavior, the effects of the proposed timber harvesting on the South Fork of Lost Creek and downstream waters must be considered.

The presence of bull trout and cutthroat trout in the Swan River and the South Fork of Lost Creek indicate that mitigating measures, including the Immediate Actions for Bull Trout Recovery agreed to by DNRC and the Governor's Bull Trout Restoration Team in 1994 (Montana DNRC 1994), should be implemented on all streams affected by the proposal.

B. *SOUTH FORK LOST CREEK*

In July of 1994, Tom Weaver, a fisheries biologist from DFWP, began gathering baseline data for the watershed. Data were obtained through species composition surveys, spawning surveys, and substrate scoring on the South Fork of Lost Creek. Evidence of both westslope cutthroat and bull trout was found. Spawning surveys, substrate scores and McNeil core sites have been monitored annually since 1994 with the results to date reported in Table 3-27.

The Flathead Basin Forest Practice Study showed a direct link between on-the-ground activity (as indicated by the Sequoia Index) and habitat quality (determined by McNeil coring). The study showed an even stronger tie between the quality of spawning habitat (indicated by the percentage of fines) and the survival of embryos to emergence. The cooperative recommended a cautious approach to management when the amount of fine material (6.35 mm or smaller) as indicated by McNeil coring exceeds 35 percent. The

TABLE 3-27. SUMMARY OF FISHERIES MONITORING DATA IN THE SOUTH FORK LOST CREEK

Parameter	FY 1995	FY 1996	FY 1997
Westslope Cutthroat Redds	7	12	19
Bull Trout Redds	9	19	28
Substrate Score (glossary)	11.7 (7/94)	11.7 (7/95)	11.6 (7/96)
McNeil Core	30.4 (3/95)	28.8 (3/96)	23.4 (3/97)

FY 1996 McNeil coring sample for the South Fork of Lost Creek showed the fine material (6.35mm or smaller) at 23.4 percent. The decreased fines and increased number of trout redds indicated in the table suggest that spawning habitat has improved, at least in the short term, perhaps as a result of high flushing flows generated by runoff from heavy snowpack in recent years.

VIII. AIR QUALITY

The project area is within Montana Airshed 2 (Kalispell) and is not in a sensitive impact zone (USFS 1992). Air quality within this airshed is considered good. Temporary reductions in air quality occur primarily during wildfires and burning of logging residue. The airshed is managed by the Montana Airshed Group which monitors weather conditions and imposes burning restrictions when dispersion and ventilation are poor.

IX. VISUAL QUALITY

The project area is visible from boats on the south end of Swan Lake, from forest roads on the western flank of the Swan valley, and from the South Fork Lost Creek road. The project area cannot be seen from residences, Highway 83, Point Pleasant Campground, or Soup Creek Campground, because of topography and the dense forest in the Swan valley.

The aesthetic characteristics of the project area from all three of these viewpoints have been altered by land management activities over the past 35 years. Timber harvest and road construction have been a part of this environment since the early 1960s, with the most recent harvest activities occurring in the 1980s. Previous harvest units in the project area are regenerated with trees in age up to 20-30 years and reaching heights up to 40 feet. Some of these units also retain large, mature seed trees.

A. *VIEW FROM SWAN LAKE AND THE WESTERN FLANK*

The portion of the project area that can be seen from the south end of Swan Lake and the western shore is approximately 4.5 miles from the lake and consists mainly of mature stands of timber. Two units that were harvested in the 1960s and 1970s also can be seen from this view point. These stands are fully stocked primarily with 20-30 year old larch saplings. The contrasting colors are most notable in the fall when the larch turn a golden yellow. Swan Lake is a popular recreation site, with peak use during the summer months.

B. *VIEW FROM SOUTH FORK LOST CREEK ROAD*

South Fork Lost Creek road extends approximately 4 miles through the project area. The road provides a view of canyon walls rising above, the creek below, and dense timber, rock outcrops, avalanche chutes, riparian areas and a variety of habitat types. Constructed primarily for hauling timber, this road currently is used for recreational purposes by an average of fewer than 20 vehicles per week.

X. RECREATION

The South Fork Lost Creek watershed area is used for a variety of recreational purposes that include hunting, fishing, camping, hiking, cross country skiing, snowmobiling, berry picking, viewing the scenery, and wildlife watching. Other use includes firewood gathering and access to the Bob Marshall Wilderness via trail 98. The trailhead of trail 98 is at the end of the South Fork Lost Creek road approximately 9 miles from Highway 83. Based on observations of DNRC personnel, recreation appears to be increasing in the South Fork Lost Creek drainage.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

I. INTRODUCTION

This chapter describes the environmental effects of each alternative on the resources described in Chapter 3, and provides the basis for the summary of environmental effects table in Chapter 2. An economic analysis also is presented. Included at the end of the chapter is a list of proposed mitigation common to all of the timber harvest alternatives.

A. *PROJECTS UNDER CONCURRENT CONSIDERATION*

The cumulative effects of past activities are discussed in Chapter 3. The related project under concurrent consideration in the Swan River State Forest (SRSF) is the Middle Soup timber sale (DNRC 1997). Additionally, the Woodward/ Porcupine Grizzly Bear Subunit has been identified on DNRC's 3-year timber sale list as the next potential project area on the SRSF. Middle Soup timber sale has been included in the cumulative effects analysis for the proposed South Fork Lost Creek timber sale.

II. FOREST CONDITIONS

The analysis of the affected environment in Chapter 3 indicates that the forests of the SRSF and the South Fork Lost Creek project area are dominated by shade-tolerant tree species to a far greater extent than historical conditions would indicate is appropriate. The data also indicate that both SRSF and the South Fork Lost Creek project area contain old growth forests in greater abundance than the historical average and greater than the retention commitments stated in the DNRC State Forest Land Management Plan (SFLMP). The forest also exists in smaller patches than indicated by the 1930s inventory. Vigor of stands within the project area is approximately equally split between fair-to-good and fair-to-poor. In general, old growth on the SRSF contains multiple canopy layers; is usually fair to poor vigor; has some to lots of large trees, and snags; has some to few amounts of coarse woody debris; and contains gross volume over 20 Mbf per acre. Old growth within the South Lost area has, in general, higher attribute levels than for the entire SRSF.

The analysis focuses on describing conditions across the entire SRSF as well as within the defined project area. Thus, it is a complete cumulative effects analysis as well, encompassing all previous and anticipated activities on the forest. This effects analysis focuses on the extent to which the various alternatives would move the forest toward average historical conditions and SFLMP commitments, and improve the vigor of the forest.

A. *EFFECTS ON STAND AGE, COVER TYPE AND VIGOR*

1. Cover Type Representation

a) Effects of Alternatives A, B, C, D and E

Chapter 3 describes the transition of cover types, through succession, from domination by shade-intolerant tree species to shade-tolerants, especially from western larch/Douglas-fir into mixed conifer types. In the 1930s, 84 percent of the SRSF was dominated by shade-intolerant species compared to the present 42 percent. Thus, to move toward 1930s conditions some stands would have to be converted back to shade-intolerants.

With Alternative A, the cover type representation would continue to shift toward shade-tolerant tree species. There also would be an increased risk of stand replacement fire, and increased susceptibility

to insects and disease. The shift would continue on a trajectory of non-sustainability.

Each timber harvest alternative would increase the amount of shade-intolerant species within treated stands, though the magnitude would be small. Alternative B shifts 32 acres of subalpine types to western larch / Douglas-fir; 121 acres of mixed conifer to western larch / Douglas-fir; and 83 acres of mixed conifer to white pine; these numbers include 22 acres of mixed conifer, dominated by cedar that would be converted to shade intolerant types.

Alternative C shifts 6 acres of subalpine to western larch / Douglas-fir; 251 acres from mixed conifer to western larch / Douglas-fir and 52 acres to white pine. These numbers include 10 acres of mixed conifer, dominated by cedar that would be converted to shade intolerant types.

Alternative D shifts 32 acres from the mixed conifer class to western larch / Douglas-fir; 91 acres to white pine and 19 acres to ponderosa pine. These numbers include 3 acres of mixed conifer, dominated by cedar that would be converted to shade intolerant types.

Alternative E shifts 10 acres of mixed conifer to western larch / Douglas-fir and 4 acres to ponderosa pine.

Alternative C would provide the greatest movement toward appropriate conditions by converting 309 acres of shade-tolerant species; followed by Alternative B which would reduce shade-tolerants by 236 acres; Alternative D would convert 142 acres to shade-intolerant species types; Alternative E shifts 14 acres to shade intolerant types. The total change in the SRSF as a result of harvesting in one drainage such as the South Fork of Lost Creek would be negligible.

2. Age Class Distribution and Old Growth Stands

a) Effects of Alternatives A, B, C, D and E

Under Alternative A, forests would continue to age, increasing multi-story conditions, insect and disease susceptibility, and the risk of catastrophic fires. Over time, the existing old growth stands would begin to lose some of the qualities generally associated with age, such as large, live trees. Other qualities would increase, especially with the loss of the large live trees, such as decadence, snags and down coarse woody debris.

Post treatment ages of stands were calculated as follows: light-reserve treatment would reduce age to zero; a moderate-reserve or heavy-reserve treatment would not change stand age. Stands treated with moderate reserve or heavy-reserve would remain sawtimber class stands. Cover type might change, because the treatments are focused primarily on removal of shade-tolerant tree species and enhancing the growing space of large shade-intolerant species.

None of the timber harvest alternatives would have any major effect on overall age class distribution on the SRSF. Alternative B enters 417 acres of old growth and would reduce old growth stand acreage by 130 acres; Alternative C enters 294 acres and would reduce old growth by 103 acres; Alternative D enters 481 acres and would reduce old growth by 200 acres; Alternative E enters 237 acres of old growth and would reduce old growth acres by 4. Alternative D would cause the greatest movement toward appropriate conditions, although its overall effect on proportions of old growth stands on the SRSF would be minor.

Under each Alternative attribute levels would be reduced in the old growth acres entered. That information is presented below in the various discussions of old growth attributes.

Within the project area (4,161 acres) there are currently 2,347 acres of old growth. Alternative B would reduce old growth stands to 2,217 acres (53 percent of project area); Alternative C would reduce old growth stands to 2,244 acres (54 percent of project area);
Alternative D would reduce old growth stands to 2,146 acres (52 percent of project area);
Alternative E would reduce old growth to 2,343 acres (56 percent of the project area).

On the SRSF, (DNRCs choice of scale to analyze for old growth retention commitments) there are currently 17,333 acres of old growth. All of the

TABLE 4-1 POST-HARVEST OLD GROWTH ON SRSF BY COVER TYPE BY ALTERNATIVE

Cover Type	Min. Acres to maintain as old growth on SRSF	Old Growth Acres Post-Harvest				
		A	B	C	D	E
Subalpine	286	1,727	1,673	1,708	1,727	1,727
Douglas-fir	17	153	153	153	153	153
Lodgepole pine	39	0	0	0	0	0
Mixed Conifer	1,123	9,327	9,147	9,174	9,125	9,317
Ponderosa pine	760	868	868	868	868	868
Western larch/ Douglas-fir	3,775	2,757	2,778	2,774	2,763	2,763
White pine	869	2,501	2,584	2,553	2,497	2,501
Total	6,869	17,333	17,203	17,230	17,133	17,329

reductions described above would retain old growth stands in proportions over the historical average and well over SFLMP commitments. Alternative D would move the project area closest to a long-term average, or appropriate condition.

b) Cumulative Impacts

Based on the current DNRC definition of old growth (see Glossary), the Middle Soup timber sale proposes to harvest 36 acres of old growth within mixed conifer cover type. The effects of this harvest would further reduce current levels of mixed conifer old-growth stands by approximately 36 acres across the SRSF.

3. Replacement Old-Growth Stands

a) Effects of Alternatives A, B, C, D and E

Alternative A would not improve the health of the forest or lead toward the development of replacement old stands. The SFLMP commits to maintain or restore at least half the historical proportion of old growth expected to occur with natural processes, and to retain sufficient replacement acres of old stands. None of the other Alternatives harvests more than 18 acres of replacement age stands.

4. Stand Vigor

a) Effects of Alternatives A, B, C, D and E

Stand vigor would continue to deteriorate under Alternative A as increased regeneration of shade-tolerant trees would crowd out more vigorous shade-intolerant species. Light- and moderate-reserve silvicultural treatments would return stands to full vigor; heavy-reserve treatments would raise vigor by one class, e.g., from the poor to fair class into the fair to good class.

Vigor of stands in the project area will be increased with each alternative. Alternatives B and C have the greatest effect. Vigor is higher at lower numbers.

TABLE 4-2. STAND VIGOR RATINGS AND EFFECTS OF EACH ALTERNATIVE (IN ACRES).

Vigor Class	A	B	C	D	E
AVERAGE VIGOR RATING*	2.69	2.46	2.46	2.49	2.62

**Average vigor rating is obtained by multiplying acres in vigor classes by 1 for the full vigor class, 2 for the good vigor class, 3 for fair, and 4 for very poor; then dividing by total acres.*

5. Patch Sizes by Cover Type

a) Effects of Alternatives A, B, C, D and E

None of the alternatives would have a profound effect on increasing or decreasing cover type patch sizes for the entire SRSF. Over time, Alternative A would result in increased patch size with little differentiation among stands. Within the project area timber harvest alternatives would have the effects shown in Table 4-3 below. Alternative B would have the greatest effect on reducing patch size while Alternative E would have the least effect.

Alternatives B and C have greater effects on mixed conifer patch sizes, while D and E have greater effects on subalpine patches.

Alternative E is most effective at retaining large cover type patch sizes.

6. Patch sizes by Age Class

a) Effects of Alternatives A, B, C, D and E

Patch size effects are shown only for the project area. At the SRSF level the effects are negligible. Age class patch size effects are greatest for Alternative E, and least for Alternative C. Alternative B reduces old growth patches the most with Alternative E having no effect.

Some of the patch size effects within the project area are artifacts of using the project area boundary as an artificial stand boundary. In many cases the stands continue outside the project area boundaries. Effects on average patch size in the project area are reductions with all Alternatives except C. In old growth stands, the existing average patch size of 334 acres would be reduced by Alternative B to 279 acres, by Alternative C to 324 acres, by Alternative D to 309 acres, and Alternative E with no reduction.

7. Patch Shape Changes for Each Cover Type

a) Effects of Alternatives A, B, C, D and E

Although reliable information on patch sizes and shapes throughout time does not exist we show the effects from the 1930s inventory compared to present conditions so as to develop some baseline information. This information will be useful in determining effects of our actions over time.

Alternative A would decrease the complexity of patch shape for each cover type due to the homogenization of cover types and the reduction of diversity.

Each timber harvest alternative would reduce the complexity of patch shape within the SRSF and the project area, except Alternatives D. In the project area, values for patch shape index for Alternative A would be 1.55, 1.54 for Alternative B, 1.50 for Alternative C, and 1.57 for Alternative D; and 1.53 for Alternative E. The lower the number , the less

TABLE 4-3. PATCH SIZE EFFECTS BY COVER TYPE FOR THE PROJECT AREA (IN ACRES).

Cover Type	A	B	C	D	E
Subalpine	547.9	532.0	549.0	368.7	368.7
Douglas-fir	10.9	10.9	10.9	10.9	10.9
Hardwood	-	-	-	-	-
Lodgepole pine	-	-	-	-	-
Mixed conifer	855.3	470.8	452.0	806.8	851.2
Non stocked	-	-	-	-	-
Ponderosa pine	30.0	30.0	30.0	26.5	30.0
Western Larch/ Douglas-fir	25.9	30.4	33.4	25.7	27.2
White pine	33.1	30.4	37.8	38.1	31.4
OTHER	18.6	18.6	18.7	18.7	18.7
TOTAL	165.7	121.7	121.9	138.1	159.5

TABLE 4-4. EFFECTS OF THE ALTERNATIVES ON PATCH SIZE FOR EACH AGE CLASS IN THE PROJECT AREA (IN ACRES).

Age Class	A	B	C	D	E
000-039	58.2	70.4	67.7	63.9	53.7
040-099	153.6	153.6	153.6	153.3	153.6
100 to Old Growth	70.0	69.6	68.5	69.7	69.8
Old Growth	334.5	278.8	324.3	309.0	334.8
Total*	133.4	129.3	133.6	125.1	115.8

complex the shape. There is some suggestion that current patch shapes are more complex than in the 1930s, as shown in Chapter 3, but reliable information on historical averages or appropriate conditions is lacking.

8. Patch Shape Changes for Each Age Class

a) Effects of Alternatives A, B, C, D and E

Over time, Alternative A would decrease patch shape complexity due to the homogenization of age classes into old-growth stands. Effects on patch shape of various age classes also would be small.

The Alternatives have a slight to nil effect on patch shape by age class with A, B, and C, unchanged at 1.49, D going to 1.50 and E going to 1.54.

9. Indicators of "Old Growth" Attributes

As shown in Chapter 3 a higher proportion of old growth stands have received partial harvest treatments on the SRSF than for the project area. Thus, representation of old growth attributes would be expected to be higher in the project area, and this is true. The analysis of attributes presented below shows these effects in the higher representation of attributes in stands selected for harvest than overall SRSF representation shows. However, when harvest effects are viewed at the SRSF scale they are negligible.

It should be remembered that the proportional representation of old growth attributes displayed in this section will be based on the amount of old growth existing either currently or post harvest, depending on whether the data is pre or post harvest. Thus, one should look at the discussion on Age Class Effects above to determine the number of acres the chart is based on.

a) Stand Structure of Old Growth

The effect of the Alternatives on old growth stand structure is shown in Tables 4-5 and 4-6. Each Alternative harvests predominantly from the uneven aged structural class, which is also the predominant structural class in the South Lost project area. At the SRSF level effects are minimal. At the project area level we see a substantial increase in single story old growth with decreases in the multi-story and uneven aged condition. The retention of greater than 4 Mbf per acre following moderate reserve harvesting is responsible for this simplified old growth condition.

Alternative E is heavily skewed to harvest in uneven-aged old growth compared to current conditions and the other Alternatives. However, because the harvests are heavy reserve they do not change stand structure designation, despite resulting in a less complex condition.

b) Stand Vigor of Old-Growth Stands

Vigor of old-growth stands is used here to indicate the degree of decadence. Refer to the discussion in Chapter 3 on vigor classes to get an indication of the degree of decadence associated with each vigor class.

Figure 4-1 shows the percentages of harvesting in old-growth stands that comes from each vigor class. Within the South Lost project area, Alternatives B and C enter roughly more than half the percentage of old growth stands from low vigor class. Alternative D targeted stands with low vigor, thus the higher percentage of harvest in the fair and poor categories.

TABLE 4-5. EFFECT ON OLD GROWTH STAND STRUCTURE BY ALTERNATIVE FOR THE SRSF. PERCENTAGES REPRESENT THE PERCENTAGE OF HARVESTED STANDS IN EACH STRUCTURAL CLASS.

	Single	Two-story	Multi	Clumps	Uneven aged
A	1%	8%	32%	28%	31%
B	2%	8%	32%	28%	30%
C	2%	8%	32%	28%	30%
D	1%	8%	31%	28%	31%
E	1%	8%	32%	28%	31%

The effects of these removals are unknown, but in each case we have more than sufficient acres of old growth to meet our SFLMP commitments. Prescriptions designed to leave snags and large down logs will help retain some of the characteristics associated with stand vigor and old growth.

As can be seen in Table 4-8 old-growth stands are increased in vigor (decreased decadence) especially with Alternatives B, C, and D. The increases in vigor come largely from the most decadent category.

TABLE 4-6. EFFECT ON OLD GROWTH STAND STRUCTURE BY ALTERNATIVE FOR THE SOUTH LOST PROJECT AREA. PERCENTAGES REPRESENT THE PERCENTAGE OF HARVESTED STANDS IN EACH STRUCTURAL CLASS.

	Single	Two-story	Multi	Clumps	Uneven aged
A	0%	3%	49%	5%	43%
B	8%	3%	47%	5%	37%
C	8%	3%	47%	5%	38%
D	3%	3%	47%	4%	44%
E	0%	3%	49%	4%	43%

FIGURE 4-1. VIGOR CLASS OF OLD GROWTH STANDS SELECTED FOR HARVEST. ALTERNATIVE A SHOWS THE SRSF CURRENT CONDITION. THE OTHER ALTERNATIVES SHOW THE REPRESENTATION OF VIGOR IN OLD GROWTH STANDS SELECTED FOR HARVEST.

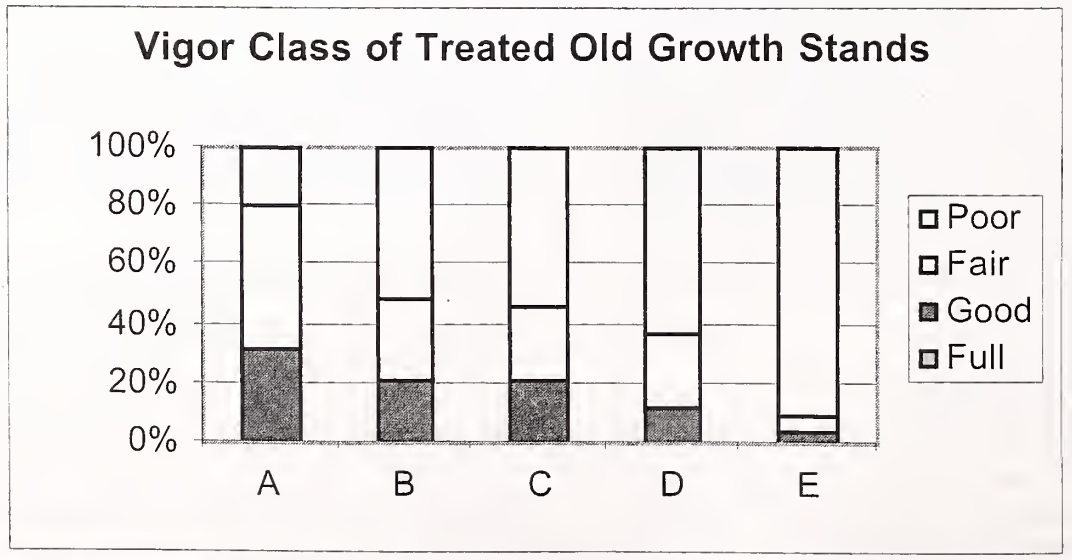


TABLE 4-7. POST HARVEST VIGOR IN OLD GROWTH STANDS ON THE SRSF. ALTERNATIVE A IS THE CURRENT CONDITION FOR OLD GROWTH WITHIN THE SRSF.

Alternative	Full	Good	Fair	Poor
A – current condition	0%	31%	49%	20%
B	1%	31%	49%	18%
C	1%	31%	49%	19%
D	0%	31%	50%	18%
E	0%	31%	50%	18%

TABLE 4-8. POST HARVEST VIGOR IN OLD GROWTH STANDS IN THE PROJECT AREA. ALTERNATIVE A IS THE CURRENT CONDITION FOR OLD GROWTH WITHIN THE PROJECT AREA.

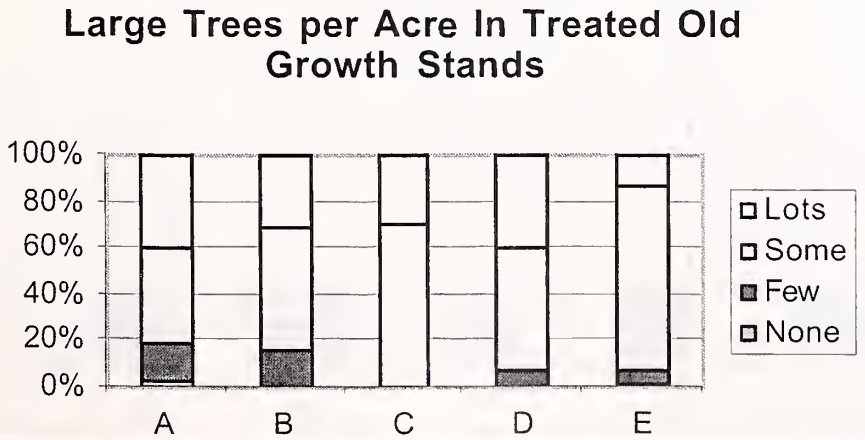
Alternative	Full	Good	Fair	Poor
A – current condition	0%	15%	59%	26%
B	9%	15%	60%	17%
C	8%	15%	58%	20%
D	3%	14%	69%	14%
E	0%	15%	68%	17%

c) Large Trees

Effects on numbers of large trees per acre in old growth are shown in Figures 4-2 and 4-3. Figure 4-2 shows both the representation of large trees per acre for the SRSF and the representation within old growth stands selected for harvest. Figure 4-3, then shows the post harvest effects of each Alternative on representation of large trees per acre within the entire SRSF.

Figure 4-2 shows that selected harvest units generally have a lower proportion of few and none large trees (or a higher proportion of 'some' large trees per acre) than does the SRSF as a whole. The effects post harvest displayed in Figure 4-3 show slight shifts at the SRSF level despite the emphasis on stands containing 'some' large trees per acre. Each alternative decreases the overall proportion of old growth with higher numbers of large trees per acre. See Appendix C for quantification of the categories used for numbers of large trees per acre.

FIGURE 4-2. THE REPRESENTATION OF LARGE TREES PER ACRE IN OLD-GROWTH STANDS SELECTED FOR HARVEST WITH EACH ALTERNATIVE. ALTERNATIVE A SHOWS THE SRSF CURRENT CONDITION. THE OTHER ALTERNATIVES SHOW THE REPRESENTATION OF LARGE TREES IN OLD GROWTH STANDS SELECTED FOR HARVEST.



Tables 4-9 and 4-10 show the effects on large trees in old growth for both the SRSF and the project area.

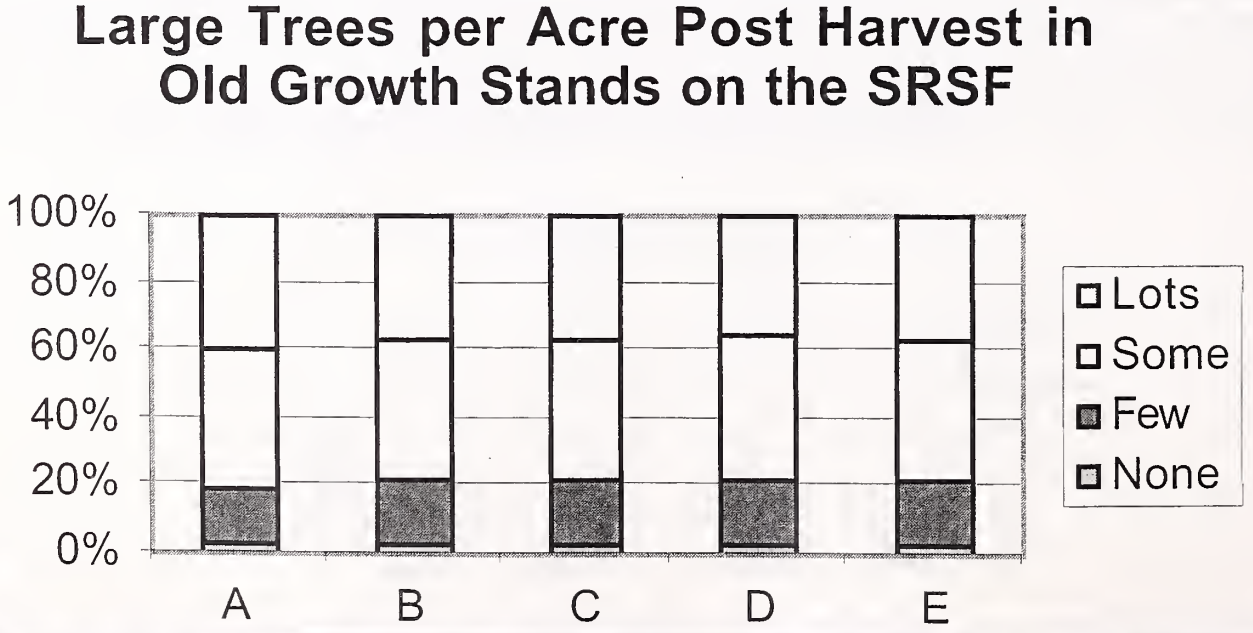
TABLE 4-9. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF LARGE TREES IN OLD-GROWTH STANDS ON THE SRSF. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE SRSF POST HARVEST. THIS TABLE DISPLAYS THE SAME INFORMATION AS DISPLAYED IN FIGURE 4-3.

Alternative	NONE	FEW	SOME	LOTS
A – current condition	3%	17%	41%	39%
B	3%	17%	42%	39%
C	3%	17%	42%	39%
D	3%	17%	42%	38%
E	3%	17%	42%	39%

TABLE 4-10. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF LARGE TREES IN OLD GROWTH STANDS IN THE PROJECT AREA. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE PROJECT AREA POST HARVEST.

Alternative	NONE	FEW	SOME	LOTS
A – current condition	0%	18%	52%	30%
B	0%	17%	56%	27%
C	0%	18%	54%	28%
D	0%	18%	58%	24%
E	0%	18%	53%	29%

FIGURE 4-3. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF LARGE TREES IN OLD GROWTH STANDS. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE SRSF POST HARVEST.



d) Snag Numbers

The same format used for Figures 4-2 and 4-3 is repeated for 4-4 and 4-5. Again old-growth stands selected for treatment are weighted more heavily to the higher categories than the representation for the entire SRSF.

As can be seen in Figure 4-4 all the treated stands for each Alternative contain some to lots of snags per acre compared to SRSF wide conditions where the few and none categories are represented slightly. The post harvest effects are slight as shown in Figure 4-5 due in part to the large number of acres in the SRSF that is old growth versus the number of acres being treated. The deliberate effort made to retain snags in harvest units also helps mitigate the effects.

Again, at the SRSF the effects of any of the Alternatives is negligible. However, and again, the effects are more pronounced at the project area level. There we see large reductions in the lots of snags category and corresponding increases in the some category.

FIGURE 4-4. THE REPRESENTATION OF LARGE TREES PER ACRE IN OLD GROWTH STANDS SELECTED FOR HARVEST WITH EACH ALTERNATIVE. ALTERNATIVE A SHOWS THE SRSF CURRENT CONDITION. THE OTHER ALTERNATIVES SHOW THE REPRESENTATION OF LARGE TREES IN OLD GROWTH STANDS SELECTED FOR HARVEST.

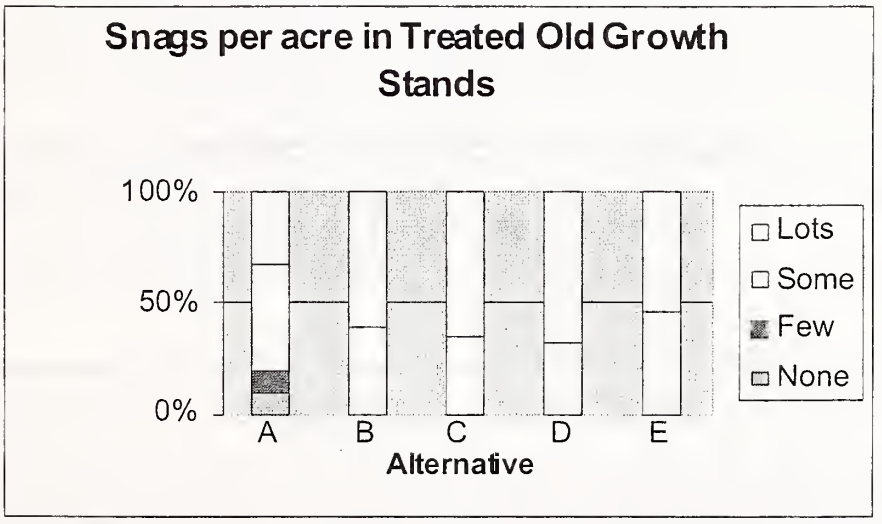


FIGURE 4-5. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF SNAGS IN OLD GROWTH STANDS. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE SRSF POST HARVEST.

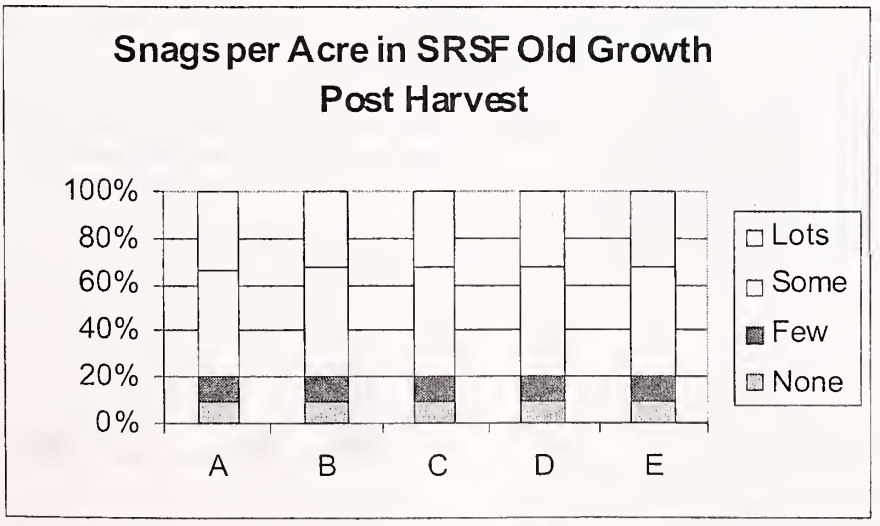


TABLE 4-11. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF SNAGS IN OLD GROWTH STANDS. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE SRSF POST HARVEST. NOTE THIS TABLE SHOWS THE SAME INFORMATION AS DISPLAYED IN FIGURE 4-5.

Alternative	NONE	FEW	SOME	LOTS
A – current condition	9%	11%	47%	33%
B	9%	11%	48%	32%
C	9%	11%	48%	32%
D	9%	11%	48%	32%
E	9%	11%	48%	32%

TABLE 4-12. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF SNAGS IN OLD GROWTH STANDS. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE PROJECT AREA POST HARVEST.

Alternative	NONE	FEW	SOME	LOTS
A – current condition	0%	2%	50%	48%
B	0%	2%	60%	38%
C	0%	2%	57%	41%
D	0%	2%	61%	37%
E	0%	2%	55%	43%

e) Coarse Woody Debris

The same format used for Figures 4-2 and 4-3 is repeated for 4-6 and 4-7. Again old growth stands selected for treatment are weighted more heavily to the higher categories than the representation for the entire SRSF.

As can be seen in Figure 4-6 all the treated stands for each Alternative contain greater amounts of the 'some' to 'lots' of CWD per acre compared to SRSF wide conditions where the few category is well represented. The post harvest effects are slight as shown in Figure 4-7 due in part to the large number of acres in the SRSF that is old growth versus the number of acres being treated. The deliberate effort made to retain CWD in harvest units also helps mitigate the effects.

Again in Figure 4-7 the effects of the South Lost project are very slight when looked at in the scale of the SRSF.

Effects at the project area level show large decreases in the 'lots' category and corresponding increases in the 'some' category. Additionally, it is anticipated that the few category would be slightly reduced, but that those stands would see a slight increase to the some category.

FIGURE 4-6. THE REPRESENTATION OF COARSE WOODY DEBRIS IN OLD GROWTH STANDS SELECTED FOR HARVEST WITH EACH ALTERNATIVE. ALTERNATIVE A SHOWS THE SRSF CURRENT CONDITION. THE OTHER ALTERNATIVES SHOW THE REPRESENTATION OF CWD IN OLD GROWTH STANDS SELECTED FOR HARVEST.

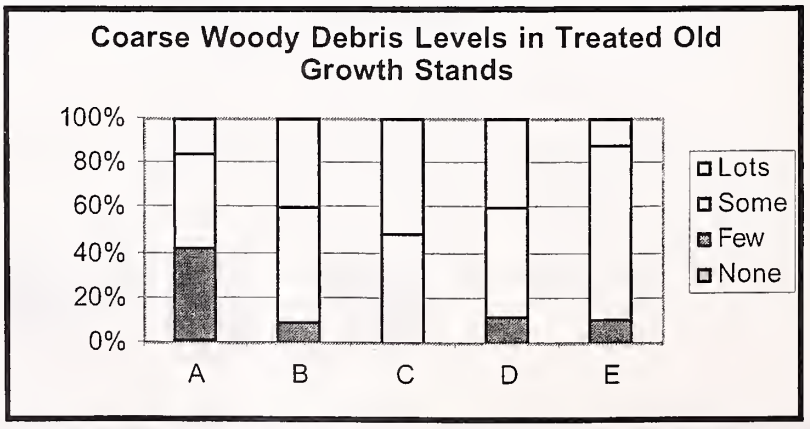


FIGURE 4-7. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF COARSE WOODY DEBRIS IN OLD GROWTH STANDS. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE SRSF POST HARVEST.

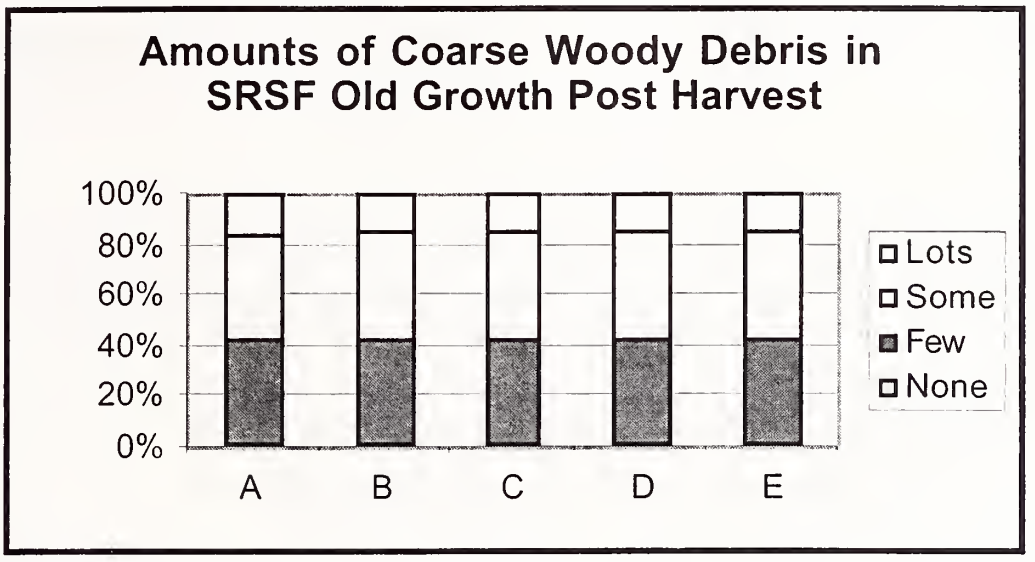


TABLE 4-13. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF COARSE WOODY DEBRIS IN OLD GROWTH STANDS. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE SRSF POST HARVEST.

Alternative	NONE	FEW	SOME	LOTS
A – current condition	1%	41%	42%	15%
B	1%	41%	43%	15%
C	1%	41%	43%	15%
D	1%	41%	43%	15%
E	1%	41%	42%	15%

TABLE 4-14. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF COARSE WOODY DEBRIS IN OLD GROWTH STANDS. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE PROJECT AREA POST HARVEST.

Alternative	NONE	FEW	SOME	LOTS
A – current condition	0%	13%	37%	50%
B	0%	12%	43%	44%
C	0%	14%	41%	45%
D	0%	12%	43%	45%
E	0%	12%	39%	49%

f) Gross Volume per Acre

Gross volume per acre data show (Figure 4-8) that harvests are planned in high volume stands (over 25 Mbf per acre) to a greater degree than their representation across the SRSF (with the exception of Alternative C); this is especially true for Alternative E. Alternative C however, harvests from a lower proportion of high volume stands than exists across the SRSF.

FIGURE 4-8. THE REPRESENTATION OF GROSS VOLUME IN OLD GROWTH STANDS SELECTED FOR HARVEST WITH EACH ALTERNATIVE. ALTERNATIVE A SHOWS THE SRSF CURRENT CONDITION. THE OTHER ALTERNATIVES SHOW THE REPRESENTATION OF GROSS VOLUME IN OLD GROWTH STANDS SELECTED FOR HARVEST.

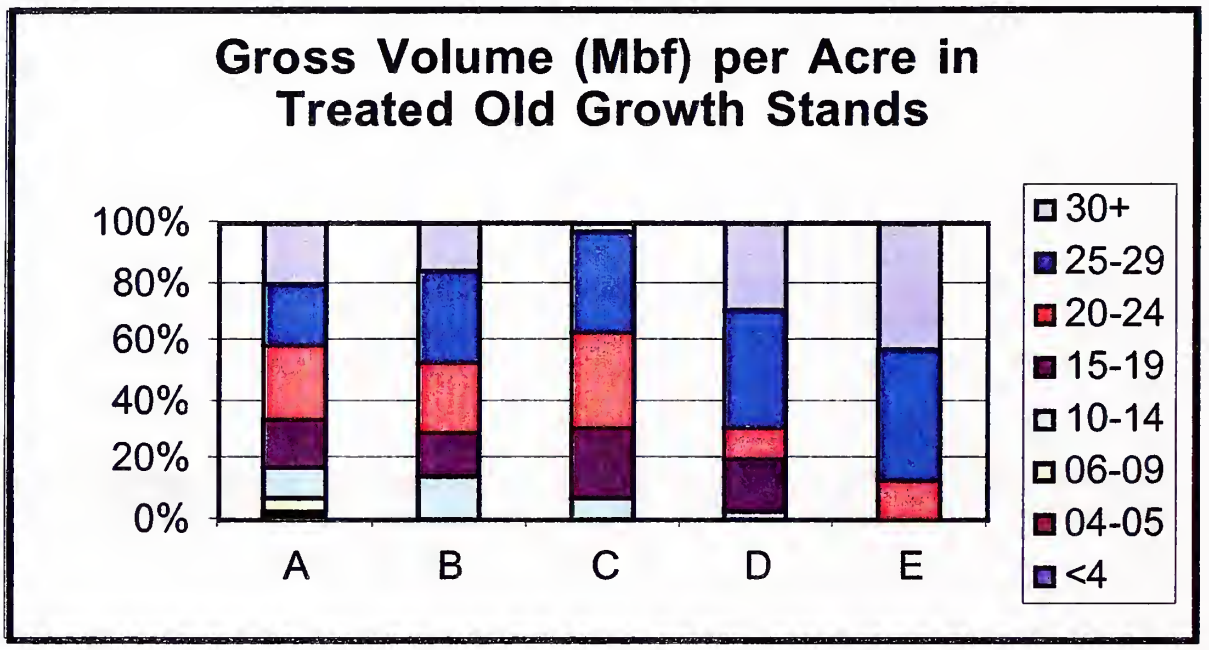


FIGURE 4-9. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF GROSS VOLUME IN OLD GROWTH STANDS. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE SRSF POST HARVEST.

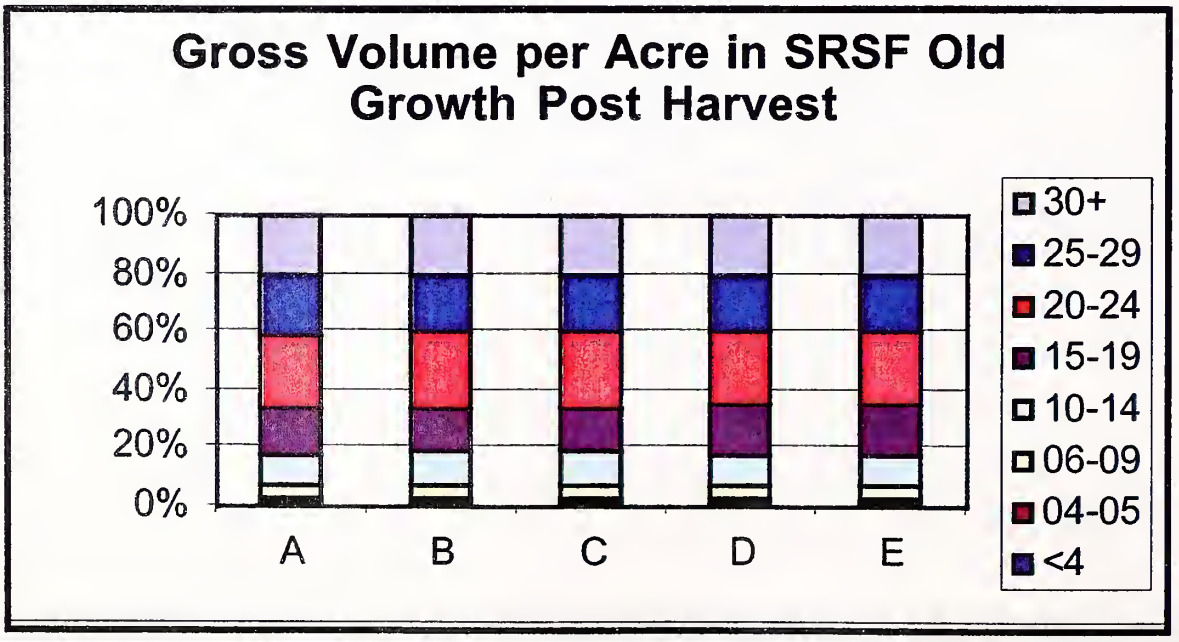


TABLE 4-15. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF GROSS VOLUME IN OLD GROWTH STANDS. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE SRSF POST HARVEST.

Alternative	<4	04-05	06-09	10-14	15-19	20-24	25-29	30+
A – current condition	1%	1%	4%	11%	16%	26%	20%	21%
B	1%	2%	5%	11%	16%	25%	19%	21%
C	1%	2%	4%	11%	16%	25%	19%	21%
D	1%	1%	4%	11%	17%	26%	19%	20%
E	1%	1%	4%	11%	17%	26%	19%	20%

TABLE 4-16. THE EFFECTS OF EACH ALTERNATIVE ON POST-HARVEST REPRESENTATION OF GROSS VOLUME IN OLD GROWTH STANDS. EACH ALTERNATIVE SHOWS THE REPRESENTATION FOR ALL OLD GROWTH ON THE PROJECT AREA POST HARVEST.

Alternative	<4	04-05	06-09	10-14	15-19	20-24	25-29	30+
A – current condition	1%	2%	9%	13%	10%	24%	23%	19%
B	1%	8%	12%	14%	7%	21%	18%	17%
C	1%	9%	9%	15%	7%	20%	19%	19%
D	1%	4%	10%	16%	14%	24%	16%	14%
E	1%	3%	9%	15%	16%	23%	18%	15%

Although Figure 4-8 suggest heavier emphasis on high volume stands selected for entry Figure 4-9 shows the effects post harvest to be a slight decrease in overall representation of high volume stands across the SRSF.

Tables 4-15 and 4-16 show the effects to gross volume in old growth stands. At the project level we see decreases in the proportion of old growth at the highest volume levels.

B. *SUMMARY OF EFFECTS ON FOREST CONDITIONS*

As with any project that harvests timber some effects will occur. However, effects will occur whether or not timber is harvested (see the effects of Alternative A outlined for each component of the vegetated environment above). The effects that occur will be of major importance to individual trees and their existence. Yet, as one expands the scale the effects naturally diminish. Within harvested stands effects may be large and noticeable. At the project level scale, even harvesting several million board feet, will have negligible effects on quantifiable components of the vegetation. At the landscape scale, at which the DNRC has committed to manage, the effects of a single project are almost not apparent. Further, when we consider our SFLMP commitments we find that some of the very small scale effects we do have, move us in the direction of desired future conditions as committed to. Thus, interpretation of the impacts from this project will vary depending on the scale at which one looks. If that scale is the landscape of the SRSF, as the DNRC has committed to manage, the effects are favorable for long term sustainability of the forest. If one looks at individual trees one will obviously see a different picture.

Within the project area vegetation effects are greatest when looking at old growth attributes. Each Alternative changes the proportional representation of attributes in old growth in the project area, reducing the proportion of all attributes in the highest category. Alternative B increases vigor (decreases decadence), and reduces snags the most; Alternative C reduces coarse woody debris the most; Alternative D reduces large trees and gross volume the most. Alternative E reduces attributes the least among all Alternatives for vigor, large trees, snags, and coarse woody debris. If subsequent projects continue to treat stands in a similar manner we would expect overall decreases in old growth attributes at the SRSF level.

Given the high proportion of SRSF that has received salvage or other partial harvesting we expect the overall condition of old growth to be somewhat low in attribute levels.

Overall effects to the SRSF would be small. None of the alternatives clearly accomplishes the most goals most effectively. Alternative A would move the forest further from historic conditions and would not move the forest in the desired future direction as indicated by the SFLMP. Alternative C accomplishes the greatest shift in cover types to shade intolerant types. Alternative D moves the SRSF the most toward appropriate age class distributions. Alternative B does the most for stand vigor, but the least for maintenance of old growth patch size, and cover type patch size. Alternative E does the least for cover type conversion, age class representation, vigor, and age class patch size, but does the most to retain old growth patch size.

Old growth attribute effects differ slightly among the Alternatives. However, mitigations designed to retain attributes within all harvested stands reduce the effects.

III. NOXIOUS WEED MANAGEMENT

Noxious weeds are less likely to invade forested sites than nonforested sites; they typically spread along open roads and on barren slopes. The effects of each alternative on the encroachment and establishment of noxious weeds are discussed.

1. *EFFECTS OF ALTERNATIVE A ON NOXIOUS WEEDS*

The no action alternative would not directly affect the encroachment and establishment of noxious weeds. Alternative A would do nothing to reduce the existing noxious weeds in the project area and spotted knapweed (Centaurea maculosa) would continue to spread along roads and disturbed areas where vegetation has not established. St. Johnswort could move into native vegetation as individual plants.

2. *EFFECTS OF ALL ACTION ALTERNATIVES ON NOXIOUS WEEDS*

All timber harvest alternatives strive to prevent new establishment of noxious weeds and control established populations along open roads.

To prevent further establishment of noxious weeds, cleaning of all road construction and logging equipment of weed parts and mud is required prior to bringing to the site. Also, disturbed roadsides and landings would be revegetated with site-adapted grasses.

Biocontrol agents would not be used because they do not work well in the strip-wise population patterns that typify the project area along roads and the cold moist climate would not support currently available biocontrol agents. Physical treatments, such as surface blading, can reduce the dispersal of seed but would not control weeds on road cut and fill slopes.

An application of herbicide followed by grass seeding would be used to eradicate noxious weeds and promote desirable native plants and seed grasses along access roads.

The herbicide treatment would use a combination of picloram, commonly known by the trade name Tordon, and 2,4-D (Amine 4). Picloram would be applied at about two quarts per acre (0.12 gallons per acre of active ingredient). 2,4-D would be applied at 3 pints per acre (0.18 gallons per acre of active ingredient).

Picloram is a restricted-use herbicide (can only be used by certified applicators) that acts on broadleaf plants as a growth regulator. Picloram is fairly persistent in soil due to its slow degradation by soil micro-organisms and ultra-violet light. Because of its persistence, picloram would provide an effective two to three year control of spotted knapweed in the project area.

2,4-D is not a restricted herbicide and is used in products marketed for home-use. It acts on broadleaf plants as a growth regulator. 2,4-D is less persistent than picloram. Soil micro-organisms break it down in a matter of weeks. For this

reason, it is safer to use closer to surface water, but it is less effective than picloram in controlling targeted noxious weeds.

Human health risks associated with herbicides used for noxious weed control have been documented in "Analysis of Human Health Risks of USDA Forest Service Use of Herbicides to Control Noxious Weeds in the Northern Region" (Monnig, 1986). The report concluded that even when considering mixing errors and a variety of accident scenarios (e.g. spills, leaks, etc.) the "No Observable Effects Levels" (NOEL) for human health are not exceeded.

Picloram and 2,4-D are specifically analyzed for human toxicology in a USDA Forest Service EIS "Noxious Weed Management on the Lolo National Forest" (Lolo, 1989). The EIS summarized studies that show these herbicides do not bioaccumulate or biomagnify. Animals high on the food chain (humans, eagles, wolves) are not expected to acquire concentrated doses of these chemicals by feeding on contaminated plants or animals. Carcinogenic studies indicate risk levels are low to non-existent.

Targeted noxious weeds are considered generally unpalatable to wildlife, but they may provide for some forage. Seeding following herbicide application is designed to replace weeds with more palatable grasses. Existing established grasses along treated roads would not be affected.

Wildlife could receive doses of herbicide by eating contaminated food either through direct consumption of herbicide-treated vegetation or indirect consumption, such as a lion feeding on elk that has consumed herbicide-treated grass. Also, wildlife (e.g., birds) may be sprayed with herbicide during application. The USDA Forest Service EIS "Noxious Weed Management on the Lolo National Forest" (Lolo, 1989) discusses in-depth toxicology for wildlife species that would typically frequent treated areas. The conclusion of the EIS is that picloram and 2,4-D are considered non-toxic if applied at recommended label doses.

Herbicide spills could put wildlife at risk. A spill could result in concentrations hundreds of times greater than that occurring in treated areas. Certified applicators would be required to treat these areas as toxic waste spills. Human activity would likely preclude wildlife from entering the spill area until it is cleaned up. Impacted areas should be small and short-term.

Herbicides pose the greatest potential risk to aquatic and fisheries resources. Impacts could occur from herbicides entering streams, lakes or wet lands via aerial drift, runoff after storm events or accidental spills. Picloram and 2,4-D can be highly toxic to some fish and invertebrates depending on species sensitivity and herbicide formulation. These herbicides can be toxic to some aquatic flora and if they enter surface water they may be detrimental to some sensitive species.

To reduce risk to aquatic and terrestrial resources herbicide application would adhere to Montana BMPs and the herbicide's specific label guidelines. Herbicide application would not be general but site specific to areas along roads where noxious weeds are occurring. Application would occur on calm, dry days to limit drift and possible surface movement off road prisms. Because of its persistence, picloram would not be applied within 50 feet of surface water. Because of its ability to break down quickly, 2,4-D would be used in areas 25 to 50 feet from surface water. No herbicides would be applied within 25 feet of surface water. Also, no herbicides would be applied to areas where relief may contribute runoff directly into surface water. All no-spray areas will be designated on the ground before application begins. Herbicides would be applied when they are most effective, in the spring (May/June), when plants are actively growing or in late summer (end of August/September).

IV. SOIL

A. *EFFECTS OF ALTERNATIVE A*

With the No-action alternative there would be some continued effects to soil resources by erosion on open roads, and skid trails with inadequate drainage. The concentration of water which contributed to the debris flow slope failure in Section 3 of the project area would not be repaired

to meet BMPs under the current proposal, and would continue to erode. Water would continue to be concentrated above this failure as dictated by existing conditions until another source of funding became available to remedy it.

B. *EFFECTS OF TIMBER HARVEST ALTERNATIVES*

Ground based timber harvesting activities have the potential to rut, compact, and displace soil. These impacts can lead to difficulty in timber regeneration, loss of soil productivity, and erosion. Susceptibility to these impacts is affected primarily by soil type, slope, and harvest method (see Table 3-23).

For all timber harvest alternatives, precautions would be taken to reduce soils impacts from road construction, skidding and mechanical site preparation. Mitigation measures are listed below. The area of detrimental soil impacts would be limited to less than 15% of the harvest units to maintain long term soil productivity (see Table 4-17).

Helicopter and cable harvest of timber would have negligible effects on soil productivity and erosivity, assuming that slash will be left on site for nutrient cycling. Landings for helicopters would be larger than those typically used for ground based yarding, but landings would be more widely spaced than conventional yarding methods and located on moderate sloping, well drained sites.

Ground-based skidding with rubber-tired skidders, tractors or clippers are the most economical methods of timber harvest on well-drained soils of moderate slope. Skidders and tractors have a higher risk of affecting soils through displacement, compaction and area of disturbance. Main skid trails can become compacted and reduce the long term productivity of the site unless remediated. Soft track skidders are specialized tractors which cause less displacement and compaction than conventional ground based yarding equipment. These can be used on steeper slopes and more sensitive soils where rubber tired skidders, tractors or clippers cannot operate.

Slash disposal and site preparation operations would incorporate a combination of broadcast burning, excavator piling and lop and scatter of slash to reduce the area of soil impacts. Site preparation by broadcast burns in cable and helicopter units would have a short term benefit to soil productivity and improve regeneration. On suitable slopes, trackhoe excavators would be used to pile brush and scarify soil. Excavators have greater flexibility to ensure even distribution of scalps for regeneration, better distribution of large woody debris, and damage soils less than brush dozers. Excavator piling and scarification would be limited to the area needed to accomplish silvicultural objectives. Woody debris would be retained to promote long term soil stability and productivity.

C. *MITIGATION MEASURES COMMON TO ALL ACTION ALTERNATIVES*

The following is a summary of mitigation measures that would be implemented to comply with BMPs and maintain long term soil productivity. Cable and/or helicopter harvest would be used on steeper slopes and would have minimal impact to soils.

Mechanical harvesting operations would be conducted when soil is adequately dry, frozen, or snow covered to minimize rutting and displacement.

Ground based (tractor) harvesting would be limited to slopes less than 40 percent. Soft track yarders are suitable on slopes up to 50-55 percent with less effect than conventional tractor skidding and would be used to reduce the degree of soil impact. Skid trails would not cover more than 20 percent of the surface in any cutting unit.

The logger and sale administrator would agree to a general skidding plan prior to equipment operations. Limit ground skidding to slopes less than 45 percent, unless soft track yarders (FMC) are used.

For long term soil productivity, avoid displacement and limit scarification to 30-40 percent of sites where required for silvicultural needs. Leave 10-15 tons large woody debris for nutrient cycling and to maintain long term soil productivity.

Cumulative Effects to Soils

Cumulative effects to soils are a concern due to road construction and ground skidding. Most of the slopes suitable for tractor harvest have been previously entered. No reentries of previously harvested units are planned. Cumulative effects would be controlled by limiting the area of soil impacts with skidding and slash disposal mitigation measures. New road construction will be minimized. Future stand entries would likely use existing roads, trails and landings and therefore present low risk of cumulative effects.

Adverse effects to soils would be minimized if these conditions are followed, along with all applicable Best Management Practices, and the recommendations of the hydrologist. Impacts to soil productivity from any timber harvest alternative are estimated not to exceed 15 percent of the harvested acres, including skid trails and landings.

The impacts of the modified alternatives on soils are shown in table 4-17.

TABLE 4-17. SUMMARY OF EFFECTS OF ACTION ALTERNATIVES ON SOILS

Alternative	Acres of Harvest	Acres of Helicopter or Cable Yarding	Acres of Tractor Yarding[1]	Acres Trafficked by Skid Trails[2]	Acres of Ground Based Site Preparation	Maximum Acres of Soil Impacted[3]	Percent of Harvest Units Impacted
A	0	0	0	0	0	0	0
B	523	340 (65%)	183 (35%)	37	183 (35%)	31	6
C	607	455 (75%)	152 (25%)	30	152 (25%)	26	4
D	514	301 (59%)	213 (41%)	43	213 (41%)	36	7
E	254	126 (50%)	128 (50%)	26	128 (50%)	22	9

1 This value includes both conventional ground based equipment and low pressure yarding equipment.

2 15-20% of ground based harvest units.

3 7.5-10% of skid trails and < 15% of excavator piled area.

V. WILDLIFE

As was previously stated in Chapter 1, the wildlife analysis was completed by a different DNRC biologist than the biologist who conducted the analysis for the FEIS. This analysis for the environmental consequences (Chapter 4) has been modified because the alternatives were modified, and in some cases, based on the new inventory data and the biologist's professional judgement, different methodologies were used to analyze the effects of the alternatives. These new analysis methods are described in the following analysis.

A. *COARSE FILTER ASSESSMENT*

1) Overview of Effects

Wildlife species use a wide array of habitats to meet their life requisites. Existing vegetative communities within the project area currently provide such requisites for many species that likely occurred there historically. However, to the extent that the current age, species composition, and structural associations of habitats diverge from that which more typically characterized the South Fork Lost Creek drainage, current conditions are believed less than optimal for the whole assemblage of species expected to occur there historically. Therefore, we expect that manipulations of forest cover aimed at providing habitat elements more similar to those that would have been present on the landscape historically to be positive.

Barrett (1996) found a mean fire interval in the project area to be 58 years, and fires occurring at this approximate interval were typically-stand replacing events. Barrett also observed that the last major disturbance in the project area occurred in about 1920. Therefore, emulation of a relatively large scale treatment by fire could be considered appropriate and likely when considering disturbance-type and time since last disturbance (78 years).

No treatment would occur under Alternative A, which would maintain forests within the project area in their current condition. In the absence of natural fire, existing stands within the project area would continue to mature into older forests with greater accumulations of coarse woody debris, snags and shade tolerant tree, shrub and herbaceous plant species. Wildlife species that thrive in forests that have substantial amounts of Englemann spruce, subalpine fir, western red cedar, and grand fir would likely benefit most in such environments where large scale disturbances are lacking. However, shade intolerant tree species, such as western larch and ponderosa pine would become a less abundant component in undisturbed forests over time, which would have adverse consequences for some cavity nesting species.

Regeneration of shade intolerant tree species, which is important for maintaining an abundance of mature trees through time, would not be expected to occur until the next major disturbance. However, the probability of stand-replacement wildfire events would be expected to increase with fuels, which would also accumulate over time. Should a large-scale fire event occur, benefits to fire-adapted wildlife would be expected. Natural openings (with the exception of avalanche chutes currently subject to frequent avalanche disturbance) and meadows would continue to be replaced by coniferous forest. Cumulatively, these trends associated with the latter stages of forest succession across broad acreages would be detrimental to species adapted to forests dominated by shade intolerant trees. Conversely, if an action alternative were chosen, the effects of the treatments would be cumulative in effect with past timber harvest activities within the confines of the project area, management on adjacent ownerships, and past activities across the SRSF.

Under Alternative A, insect and disease activity would remain at existing levels in the near-term, but would likely increase over time as stands would mature. Species adapted to take advantage of such increases in insect and disease activity would be expected to benefit. Overall, species that benefit from extensive acreages of mature and old growth forest would benefit, whereas those that prefer less dense forest and non-forested habitats would not.

All proposed action alternatives would maintain substantial unharvested acreage in the condition described above, but would also create patches of

less dense forest of varied structure, amount and distribution. Each of the action alternatives would promote the regeneration of shade intolerant tree species to some degree. The least amount of regeneration would be expected to develop following heavy reserve treatments. All action alternatives also have some harvest units positioned adjacent to existing old regeneration units, which in combination would increase their functional patch size. Alternative E is the action alternative most similar to Alternative A in effect, and would harvest the least acreage. The least amount of stand-replacement-type harvest would occur under Alternative E. Harvest units intended to emulate high intensity disturbance caused by wildfire (Light Reserve and Moderate Reserve treatments) would promote the development of young stands that would be beneficial for some species preferring early successional forest, such as snowshoe hares, but would not benefit some old growth associated species, such as pileated woodpeckers in the near-term. Treatments proposed under Alternatives B through E would presumably vary in their effects on wildlife in relative proportion to the acreages that would be treated under the various treatment scenarios and their effects on structural attributes. Alternative C would harvest the greatest acreage emulating the most severe disturbance, followed by Alternative B (523), D (514) and E (254) respectively. Alternative C would also harvest the greatest number of acres overall (607).

2) Stand Age Characteristics: Effects on Wildlife

The vegetation analysis indicates that current acres of old growth on the SRSF are less than those estimated in the 1930s inventory, but greater than would be expected as a long term average condition. It also indicates that over-abundances of old growth occur in the Douglas-fir, white pine, mixed conifer (includes stands dominated by western red cedar) and subalpine fir cover types, while shortages occur in ponderosa pine, western larch/Douglas-fir, and lodgepole pine types (comparison of Tables 3-4 and 3-10). These differences are attributable to differential selection of cover types that were harvested in the past, and cover type conversions that have taken place through the combined influences of fire exclusion and forest succession. Some wildlife species that are typically associated with old growth in the cover types that are over-represented have presumably done well on the SRSF, while those that are associated with under-represented types have probably not benefitted (recognizing that patch attributes may limit use by some species). We also recognize, however, that when considering a broad view of the Swan Valley and surrounding foothills and mountainous drainages with regard to past management across all ownerships, old forest amounts may currently be below the range of naturally occurring variation that would have been expected under historic conditions.

While acreages of younger age classes of stands on the SRSF vary somewhat between current and 1930s' conditions, they appear to be somewhat lower than characterized the area as a long-term average. Existing young stands on the SRSF are generally the result of past regeneration harvesting.

Under Alternative A, and in the absence of large, natural disturbances, stands within the project area would continue to mature into old forests over time with higher levels of decadence, and greater accumulations of coarse woody debris and snags that would provide structural elements usable by old growth associated species. Young conifer stands comprised of seral species would become increasingly rare over time. Additional within-stand structure would also develop through increased establishment of shade intolerant tree species in understory and mid story levels of vegetation, which would provide security, nesting habitat and/or feeding substrate for some species. Shrubs that prefer well-lighted environments would be replaced with shade tolerant species within older forests that can have differing cover and forage values. Wildlife species that prefer dense forests with an abundance of structural elements associated with older forests would benefit from the lack of management and/or large, natural disturbance over time. Species that benefit from more open and/or young forest conditions, and make little use of coarse woody debris, snags and well developed canopy levels would not be favored.

Under all Action Alternatives some amount of stand replacement-type harvest would occur (i.e.,

light and moderate reserve treatments). Thus, young age classes of stands would likely develop several years following treatments. Although DNRC would not consider stand age to change under the moderate reserve treatment (for stand classification purposes), a management goal for this treatment type would be to substantially increase the abundance of young-aged trees on these sites. We recognize that stands meeting the DNRC minimum requirement for old growth do not necessarily meet the needs of old-growth associated species that prefer densely forested climax stands in latter stages of development. The old-growth network, previously discussed in the vegetation section of Chapter 3, is being used as a planning tool to address these and related concerns.

Alternative E would enter only 8 acres of old growth utilizing the light reserve and moderate reserve treatments, and 229 acres would be entered with the heavy reserve treatment. Alternative E would be most similar to Alternative A in effect of all the action alternatives considered. Due to the small area influenced by the stand-replacement-type treatments proposed under Alternative E, minimal effects to old-growth associated species *or* species adapted to open forest conditions would be expected to occur. The least amount of old growth would be entered under this alternative (237 acres), thus reducing the amount of old growth by only 4 acres. The heavy reserve treatment would alter the distribution and abundance of attributes and decadence commonly associated with old growth forest (Bull et al. 1997), however, stand age per se would not change. Attributes that would be altered and/or reduced include (but are not necessarily limited to): large tree abundance, coarse woody debris, snag abundance (inadvertent loss due to safety concerns and mechanical disturbance), diseased tree component, trees making up the mid and lower canopies, agents associated with decay, and shade tolerant understory plant species. Species sensitive to the alteration or removal of these attributes, such as brown creepers and red-backed voles, would be negatively affected. Whereas others, such as goshawks (*Accipiter gentilis*) could benefit from the creation of some open forest conditions for foraging. Maintaining a characteristic representation of seral tree species in the overstory would promote the long-term development of quality snags important for cavity-nesting species. Benefits to cavity users would be derived by maintaining some stands at various densities to reduce risk of stand-replacing fire events (100% lethal) across broad landscapes.

The manipulation of older mixed conifer, subalpine fir and western white pine stands (Alt. D only) as proposed under Alternatives B, C and D, would change the distribution of stand ages represented on the SRSF in a manner that reduces old growth, creates younger-aged stands, and moves the forest toward both long term average, or appropriate conditions, as well as toward climatic section averages. Acreages of old growth stands within these cover types would be reduced, but overall would remain near historic levels for the forest following proposed treatments. Young larch/Douglas-fir stands that are currently relatively abundant across the forest would increase further, however, some sites would likely regenerate other species and develop into, or continue to be classified as mixed conifer stands. It is somewhat unclear how Alternatives B, C and D would vary in their effects on wildlife with regard to stand age, and effects would also ultimately vary among those species considered. The greatest amount of old growth would be entered under Alternative D (481 acres). However, 417 acres would be entered under Alternative B, with a greater proportion being treated with stand-replacement-type treatments (294 acres). Alternative C would have a lesser effect with regard to total acres entered (295 acres), but would still harvest about 250 of those acres using stand-replacement treatments. Because Alternatives B, C and D each harvest about the same acreage using more severe treatments (240-292 acres), we expect their effects with regard to changes in stand ages to be similar. Old growth associated species that are sensitive to even minor levels of disturbance would be most influenced by Alternative D. However, species more adversely influenced by more intensive disturbances would be most influenced by treatments proposed under Alternative B. Species preferring younger-aged stands or use them to obtain requisites for maintenance and/or reproduction would derive greatest benefit from implementation of Alternative B. The heavy reserve treatment implemented under these alternatives would similarly alter the distribution and abundance of

attributes and decadence commonly associated with old growth forest as described above.

Cumulative Effects

If an action alternative were chosen, additional treatments would be cumulative to past harvest in the project area, harvest on adjacent ownerships, and past management across the SRSF in their effects on wildlife. Should the amount of old growth forest be below the range naturally occurring across the Swan Valley and nearby mountain ranges, further reductions of existing old growth proposed under all action alternatives would be detrimental for some old growth associated species. Species that do not use old growth for meeting life requisites would either be uninfluenced or would benefit from proposed treatments.

3) Patch Characteristics: Effects on Wildlife

Under Alternative A the size, shape and distribution of existing patches forest and non forest would remain unchanged in the near-term. In the absence of large, natural disturbances, reduction in patch size of non forest, reduction in patch shape complexity, and increases in forested patch size would be the expected trend over time. Number of patches would also be expected to decrease with time, and connectivity among older, shade tolerant dominated forested habitats would increase. Edge habitat associated with forest/non-forest boarders would be maintained at minimal levels and would be expected to decrease through time. Selection of this alternative would improve conditions for species that benefit from large acreages of older interior forest, but would not improve conditions for species preferring edge habitat, open forest, or young forest conditions.

The South Fork Lost Creek Project Area is currently maintaining habitat that possesses greater patch sizes than the SRSF. Therefore, selection of this alternative would provide greatest benefit for buffering the effects of past management on patch size and reduction of old growth forest when viewed cumulatively with management that has taken place across ownerships within the Swan Valley.

Should any of the action alternatives be selected, some reliance on the N1/2 of the SE 1/4 of section 3 (USFS ownership) would be necessary for maintaining connectivity of dense older forest across the project area. Should management occur within stands on this USFS portion of section 3 in the near future, substantial reductions in functional connectivity could result; subsequently inhibiting movements of some species. Alternative E, which would treat most acres proposed using the heavy reserve treatment, would have the highest likelihood of maintaining functional connectivity should management occur on USFS ownership in section 3.

Influences of all proposed action alternatives would vary in their effects on patch shape, edge, size and connectivity. Each of the proposed action alternatives would also vary in their effects on wildlife with regard to extent of alteration and juxtaposition of newly created open-forest patches within the South Fork Lost Creek drainage. All action alternatives would decrease existing patch size of dense, older stands, and following successful regeneration, would increase the size of younger-aged patches. Widths of old forest patches that currently provide connectivity would promote movement and gene flow among terrestrial wildlife populations, would be decreased. However, the extent that such reductions in width would inhibit actual movements or use is unknown. Assuming no treatment of USFS ownership in section 3, residual patch widths following treatment under any action alternative likely maintain some function, and most patches of old forest would remain well connected by forested parcels greater than 300 feet (~100 meters) in width. Greatest levels of within, and across drainage, connectivity would be maintained post-treatment under Alternatives B and E. We suspect that patch shapes would be made less complex under all action alternatives. However, various degrees of harvest intensity, retention and blending with existing patches make changes associated with this patch attribute difficult to predict with certainty.

Alternatives B, C, and D prescribe stand-replacement harvesting in older, densely stocked stands on northerly aspects where increases in edge would be of greatest concern. However, all of the stand-replacement harvest units on northerly

aspects (with the exception of Unit 6, Alt. C) would expand existing young patches with more similar age and structural characteristics. While this would provide benefits for some species, interior conditions lost through harvest could take decades to develop. Unit 6 proposed under Alternative C is relatively unnatural in size and shape, would increase edge, and decrease connectivity between the South Fork Lost and Cilly Creek drainages.

Old growth mixed-conifer stands dominated by western red cedar are found in sections 1-4 (T24N, R17W). Portions of these stands would be directly influenced by all of the action alternatives. Stand density and structural attributes would be reduced by amounts proportional to the intensity of treatment they would receive (as described in the Age Characteristics Effects section). Acres of old growth mixed conifer stands with relatively high attribute levels that are dominated by western red cedar that would be entered by each Alternative are: Alt. B-94, Alt. C-52, Alt. D-26 and Alt E-23. Reduction of old growth of this type would occur on 22 acres in Alt. B; 10 acres with Alt. C; 3 acres with Alt. D; and 0 acres with Alt. E. Species that prefer dense, old cedar stands, such as the brown creeper and the winter wren, would be disadvantaged and potentially displaced by treatments proposed under the action alternatives. However, other relatively large patches of old growth cedar high in old growth attributes would remain post-treatment under all action alternatives.

Under all action alternatives, some harvest would occur on southerly exposures. Some forest that provides interior conditions exists on southerly exposures within the project area (found primarily in sections 2; and 3). However, forest conditions on south exposures within the project area tend to be drier sites that grow in a less dense condition, and have experienced stand altering disturbances at more frequent intervals. Due to these factors, forests found on these southerly exposures have tended to develop and exist in a more naturally fragmented condition. Large, rocky features supporting little forest cover occur in sections 2 and 3, and avalanche chutes found in section 1 all provide elements of natural fragmentation on southerly exposures. Under Alternative E, about 18 acres would be treated on southerly exposures, which would be expected to have a minimal effect on species sensitive to alteration of interior forest patches. Alternatives B, C, and D harvest more acres on southerly exposures (129, 279, and 91 acres respectively). Expected effects on wildlife would be roughly proportional to acreage treated. Under Alternatives B, C and D, edge would be created along buffers adjacent to the avalanche chutes occurring in section 1. Foraging conditions for some herbivorous species would be improved in treated stands, especially those proposed under Alternatives B and C that occur between avalanche chutes. However, patches providing mature forest cover, and connectivity would be sacrificed.

Cumulative Effects

Under any selected action alternative, additional treatments would be cumulative to past harvest in the project area, harvest on adjacent ownerships, and past management across the Swan Valley. Treatments proposed would contribute cumulatively to reductions in patch size within mature and old forest, and increased patch size within younger-aged forest. This would be detrimental to some mature and old growth associated species, while species that do not use older forest for meeting life requisites would either be uninfluenced or benefit.

4) Special Habitats

a) Rock outcrops and cliff features in sections 1 and 2 (T24N, R17W). Minimal activity would occur on these sites under any of the proposed action alternatives, and no roads would be constructed across them. These areas would not be affected by this project.

b) Avalanche chutes and subalpine meadows located in section 1 (T24N, R17W). While these features would not be influenced directly by any of the action alternatives, forest cover would be removed near them under Alternatives B and C. This could alter current use patterns of wildlife associated with these features. The length of time that use would be altered or the area avoided is unknown. Species that use these habitats could also be temporarily displaced during harvest

activities that would occur under Alternatives B and C. Little displacement or altered use would be expected under the other action alternatives.

c) Riparian vegetation communities associated with South Lost Creek in sections 1-4 (T24N, R17W). These communities would not be altered by activities proposed in this document. However, species associated with these habitats that are sensitive to disturbance could be temporarily displaced by project-related activities, such as road improvement and hauling on road #680. Greatest levels of disturbance along South Fork Lost Creek would be expected to occur under Alternatives B, C, and D.

B. *FINE FILTER ASSESSMENT*

1) Threatened and Endangered Species

a) Grizzly Bear

i) Harvest Operations

Eleven Bear Management Subunits have been designated in the Swan Valley Grizzly Bear Conservation Agreement (USFWS 1995b). These subunits are watershed-based, averaging about 50 square miles each, and include spring, summer, and fall grizzly bear habitat.

The parties to the SVGBCA have agreed to limit their commercial operations by concentrating and rotating harvests through the subunits in the conservation area, leaving 7 of the 11 subunits inactive during the non-denning period (4/1 - 11/15) at any given time for periods of at least 3 consecutive years. This rotating harvest schedule is designed to reduce the potential for commercial harvesting activities to disturb grizzly bears.

The Middle Soup Creek Project Area (DNRC 1997) and the South Fork Lost Creek Project Area are located within the South Fork Lost Soup Subunit (Figure 3-2). Under SVGBCA, harvest activity is permitted in the South Fork Lost Soup Subunit from 1997 until April 15, 2000.

ii) Security Cover

SVGBCA specifies that adequate hiding cover be maintained for grizzly bears throughout each Bear Management Subunit. Additionally, visual screening is to be maintained along open roads, and between roads and even-aged harvest units to reduce line-of-sight distances that provide more security for grizzly bears.

iii) Linkage Zones

Four "linkage zones" to provide movement corridors for grizzly bears crossing the Swan valley are recognized in SVGBCA. The purpose of these linkage zones is to provide secure, low elevation feeding areas for grizzly bears in spring and prevent spatial isolation of the Mission Mountains grizzly bear population. Riparian habitat preferred by grizzly bears in linkage zones is to be protected through intensive road management (described below) and seasonal operating restrictions.

iv) Road Management

To minimize risks to grizzly bears from human-bear interactions, Plum Creek, DNRC and USFS have agreed to work cooperatively to limit motorized access in the Swan Valley Conservation Area (as defined in the SVGBCA). Major public travel routes and roads to private residences are not affected by this agreement. As a state agency and a private company, DNRC and Plum Creek Timber Co. respectively are not subject to SVGBCA total road density standards. However, the USFS will not increase total road density on its ownership, and all parties to the agreement will cooperate in identifying roads on their lands which are unnecessary for management and can be closed to all uses during the spring, summer and fall.

v) SVGBCA Provisions

The following standards and guidelines from the Swan Valley Grizzly Bear Conservation Agreement are incorporated into all alternatives:

- Any commercial timber harvest that would occur under any of the proposed alternatives would be scheduled for completion by April 15, 2000.

- Visual screening would be retained between open and restricted roads and cutting units with light or moderate-reserve harvest, except as necessary to accommodate cable yarding.
- No point in any light or moderate-reserve harvest unit would be more than 600 feet from cover.
- Light or moderate-reserve harvest units adjacent to open roads would not exceed 1 acre.
- Only uneven-aged harvest prescriptions would be used where timber is harvested within riparian zones.
- All owners are to manage their land to maintain a minimum of 40 percent of each BMU subunit in hiding cover.

Compliance of each alternative with SVGBCA standards, guidelines, and recommendations is discussed below.

vi) Open Road Density

Effects of Alternative A

Under Alternative A, the existing road system would remain as is; no currently open roads would be restricted, no currently restricted roads would be opened, and the existing road along South Fork Lost Creek would remain in its current condition. The percentage of the South Fork Lost Soup BMU Subunit with an open road density greater than 1 mile per square mile would remain the same as at present (28 percent for all ownerships and 35 percent for DNRC ownership).

Effects of Alternatives B, C, D and E

For all four action alternatives, approximately 1.7 miles of the existing road (road #680) that parallels the South Fork of Lost Creek would be closed and replaced with a new road, approximately 500 feet up slope. Also, in cooperation with the USFS to maintain or reduce Total Road Density on their ownership, about 0.9 miles of existing currently-gated road on DNRC ownership, would be closed with berms, which would render them inaccessible for motorized public or administrative use.

Following closures accomplished as a part of this project, the percentage of the South Fork Lost Soup BMU Subunit with an open road density greater than 1.0 mile per square mile would be reduced from 28 to 25 percent for all ownerships and 35 to 32 percent for the DNRC portion of the subunit under each of the action alternatives (see discussion of effects under Total Road Density heading for additional details).

vii) Total Road Density

DNRC and Plum Creek Timber Co. are not subject to SVGBCA total road density standards. Monitoring of this variable, however, assists the Forest Service, which is accountable for total road density on its land under the SVGBCA. New roads associated with proposed harvest activities under all action alternatives would cause minor increases in Total Road Density on USFS ownership, which would not be allowable under the SVGBCA or the Flathead National Forest Plan. Thus, completion of a needed cooperative Right-of-Way agreement necessary for this project, would not have been possible. Therefore, 0.9 mile of key, additional existing road on DNRC ownership would be bermed in the westerly portion of the South Fork Lost Creek Drainage. This action would reduce existing Total Road Density on DNRC and USFS ownerships. Using the moving windows method, total road density is expressed as the percentage of an area with a total road density of at least 2.0 miles per square mile. A map showing roads and their status within the BMU is displayed in Figure 4-10. Maps displaying roads proposed under each alternative are displayed in Figures 2-2 thru 2-5.

Effects of Alternative A

Total road density would remain the same as the existing condition with a total road density of at least 2.0 miles per square mile on 31 percent of the entire South Fork Lost Soup BMU Subunit, on 41 percent of DNRC lands within the subunit, and on 14 percent of USFS land in the subunit.

Effects of Alternatives B and C

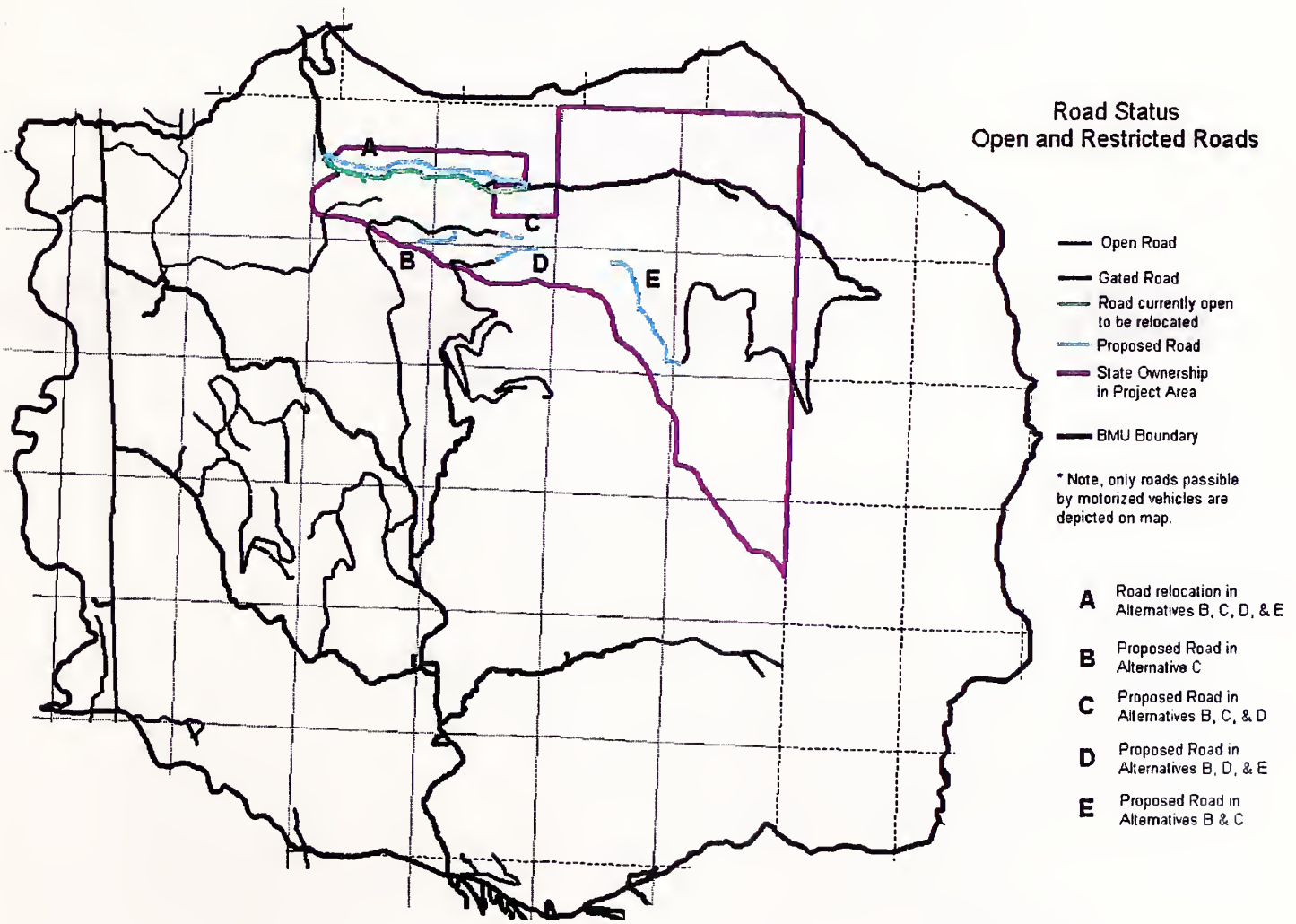
Alternatives B and C would not cause an increase total road density for the subunit; thus, total road density would remain at 31 percent. For DNRC

ownership within the subunit, total road density would increase from the existing 41 percent to 42 percent. Total road density on USFS ownership within the subunit would be decreased from 14 to 13 percent.

Effects of Alternatives D and E

Under Alternative D, total road density would remain at 31 percent for the entire subunit. Under Alternative E, total road density for the entire subunit would be reduced from 31 percent to 30 percent. Under Alternatives D and E, existing total road density on DNRC ownership within the subunit would remain at 41 percent. Total road density on USFS ownership would be reduced from the existing 14 percent to 13 percent under both alternatives.

FIGURE 4-10. ROAD STATUS


Road Status
Open and Restricted Roads
Open Road
Gated Road
Road currently open to be relocated
Proposed Road
State Ownership in Project Area
BMU Boundary
* Note, only roads passible by motorized vehicles are depicted on map.
A Road relocation in Alternatives B, C, D, & E
B Proposed Road in Alternative C
C Proposed Road in Alternatives B, C, & D
D Proposed Road in Alternatives B, D, & E
E Proposed Road in Alternatives B & C
A
B
C
D
E

viii) Hiding Cover

For the purposes of this analysis, it was assumed that hiding cover would not be retained following any level of harvest. Under all treatments some residual cover would remain, but in varied amounts and distribution. Therefore, we expect these to represent somewhat conservative estimates of the actual effects on cover attributes. Figure 4-12 shows existing grizzly bear hiding cover.

Effects of Alternative A

Alternative A would retain the existing 79 percent hiding cover currently estimated within the South Fork Lost Soup BMU Subunit. Whereas, 80 percent of the DNRC portion of the subunit would continue to provide hiding cover.

Effects of Alternative B, C, and D

These alternatives would include harvest on 523, 607 and 514 acres respectively. Hiding cover would remain at 79 percent for the entire subunit under these alternatives and decrease from 80 to 77 percent for the DNRC portion of the subunit. All residual amounts of cover would be well within compliance of SVGBCA's 40 percent hiding cover standard for each of these alternatives post-treatment.

Effects of Alternative E

This alternative would harvest 254 acres. Hiding cover would remain at 79 percent for the entire subunit under this alternative, but would decrease from 80 to 79 percent for the DNRC portion of the subunit. Residual amounts of cover would also be well within compliance of SVGBCA's 40 percent hiding cover standard for this alternative post-treatment.

ix) Core Area

DNRC and Plum Creek Timber Co. are not subject to SVGBCA core area standards although they may voluntarily contribute core. DNRC monitoring of core area percentage in the Swan Valley Conservation Area BMU subunits helps USFS meet its SVGBCA obligations (Figure 4-11, Core Map). Besides the spatial definition of core area (at least 2,500 contiguous acres at least 0.3 miles from motorized access routes), core areas should remain intact for at least 10 years (IGBC 1994). However, the following discussion of alternatives only compares the effect of each alternative on land that meets the spatial definition of core area.

Effects of Alternative A

Under the no-action alternative, 38 percent of the South Fork Lost Soup BMU Subunit would continue to meet the spatial definition of core area. Twenty-six percent of the DNRC ownership within the subunit currently would qualify as core area, and 61 percent of the USFS ownership within the subunit would continue to qualify as core area under all alternatives considered (including A, B, C, D and E).

Effects of Alternatives B and C

Alternatives B and C would increase total core area within the subunit from 38 percent to 39 percent; however, core would remain at 26 percent on DNRC ownership.

Effects of Alternatives D and E

Under Alternatives D and E, core area would increase to 40 percent within the subunit, and increase core area to 29 percent on DNRC ownership.

Effects of Alternative B,C, D, and E on USFS Ownership

The relocation of the South Lost Creek Road would reduce core area on USFS land by 0.67 percent. However, through an additional road closure within the Soup Creek Drainage that was negotiated between DNRC and USFS managers (Nov. 1998, Figure 4-11, Core Map), net core acres would be increased by 70 acres on USFS ownership under all of the action alternatives. The net result of road relocation and additional road closure in Soup Creek would yield core estimates of 61 percent on USFS ownership within the BMU.

FIGURE 4-11. *CORE AREA MAP*

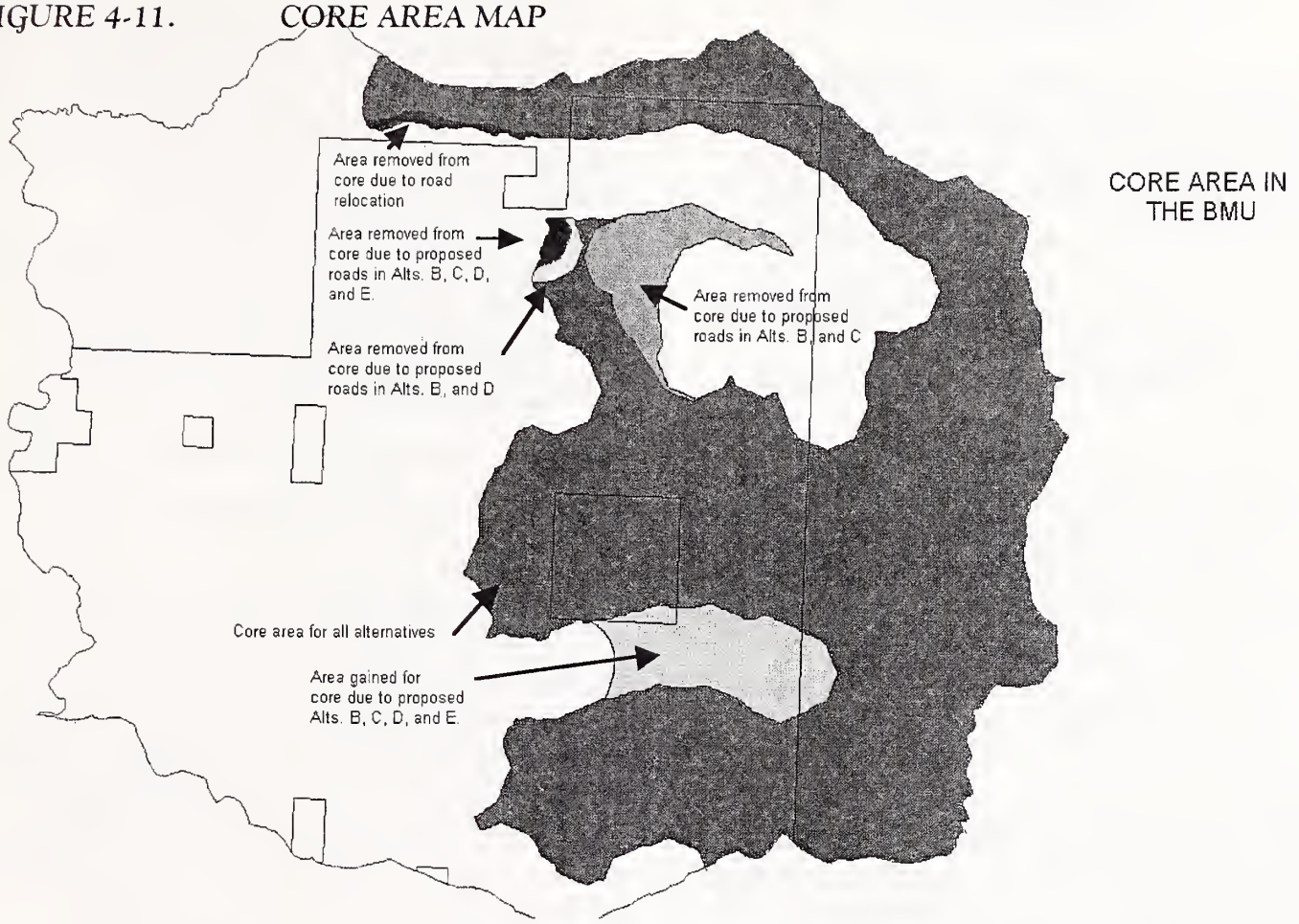
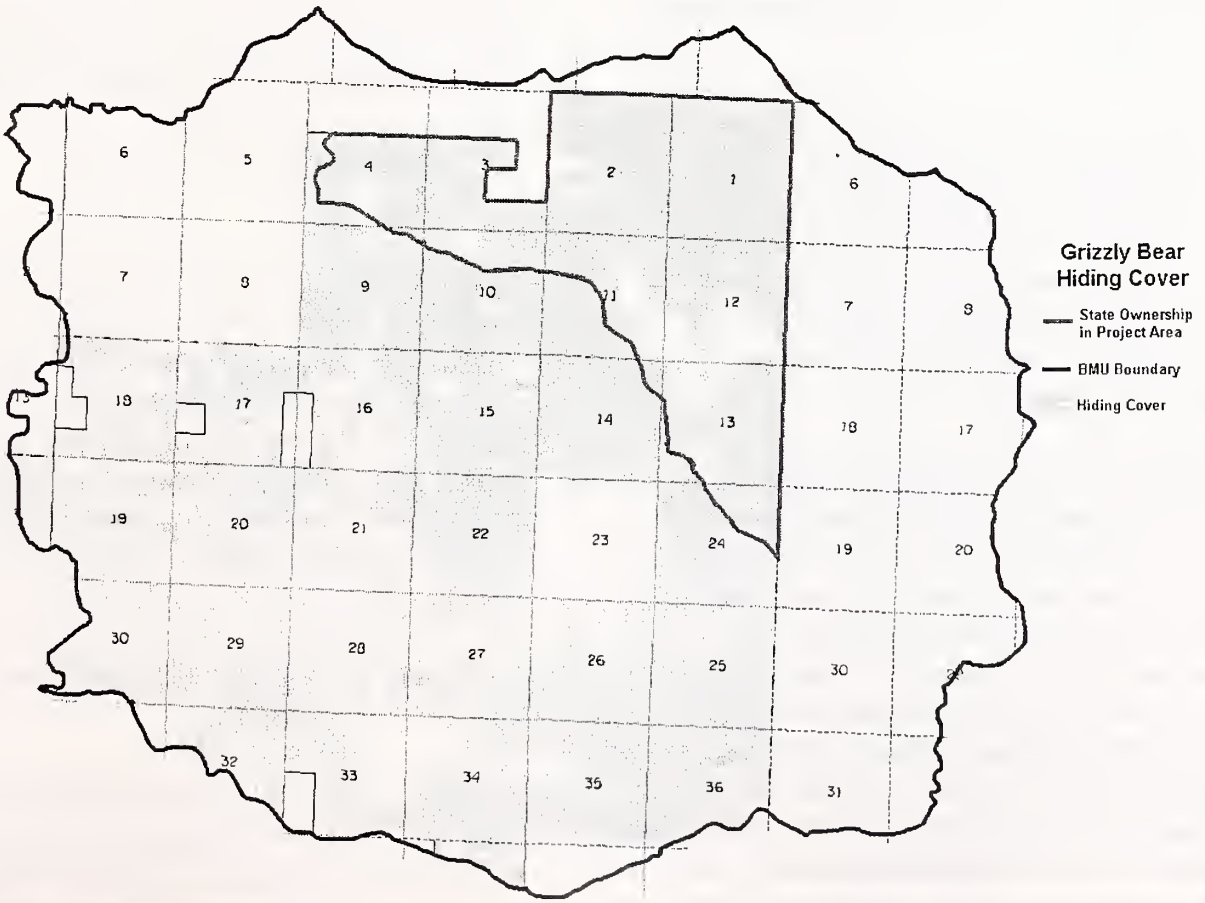

Area removed from core due to road relocation
Area removed from core due to proposed roads in Alts. B, C, D, and E.
Area removed from core due to proposed roads in Alts. B, and D
Area removed from core due to proposed roads in Alts. B, and C
Core area for all alternatives
Area gained for core due to proposed Alts. B, C, D, and E.
CORE AREA IN THE BMU

FIGURE 4-12. *GRIZZLY BEAR HIDING COVER*



x) Cumulative Effects

DNRC, the USFS, and Plum Creek Timber Company are all parties to the SVGBCA, and together, administer approximately 99 percent of the South Fork Lost Soup BMU Subunit. Non-industrial private landowners administer the remainder of the subunit. Because of their majority ownership of the subunit, activities by the DNRC, USFS, and Plum Creek would substantially account for cumulative effects within the subunit.

In addition to the proposed South Lost Timber Sale, other past and ongoing DNRC activities in the South Fork Lost Soup BMU Subunit include the Middle Soup timber sale, three salvage permits: the '97 Salvage I and II Salvage, and the Section 20 Salvage; and the 1996 Yew Bark Harvest sale. Development of the Middle Soup timber sale was completed prior to the effective date of the SVGBCA, however, all timber harvest alternatives comply with SVGBCA guidelines. The remaining 5 projects were developed after the effective date of the SVGBCA and comply with SVGBCA guidance. No other activities are known to be ongoing or planned by DNRC, USFS, or Plum Creek in the South Fork Lost Soup Subunit during the remainder of the Active Period, which would occur through 1999.

The 1996 Yew Bark Harvest was completed during the spring and summer of 1996. The '97 Salvage I and II was conducted during summer 1997. The Section 20 Salvage is planned for winter 1998. None of these three projects measurably reduce hiding cover in the subunit, create new roads, or alter the status of existing roads or security core habitat in the subunit.

The Middle Soup Creek Timber Sale is scheduled for harvest during the winter of 1998-99 and possibly 1999-2000. Since primary harvest activities ("commercial use") on this timber sale would be conducted during the grizzly bear denning season (November 16 - March 31), this sale could also be logged in subsequent winters, independent of the Active Period as currently described in the SVGBCA. The preferred alternative in the Middle Soup Creek EIS (Alternative B) would reduce hiding cover by about 44 acres, essentially maintaining the existing estimate of hiding cover in the subunit at 79 percent. Alternative B would also reduce the percentage of the South Fork Lost Soup BMU Subunit with an open road density greater than 1 mile per square mile from 34% to 28%. Management of the subunit under Alternative B of the Middle Soup Creek EIS would not change Total Road Density (31% of the subunit with a TRD greater than 2.0 miles per square mile) or Security Core Area (38% of the subunit).

All of the four timber harvest alternatives proposed in the South Fork Lost Creek project would reduce the existing open road density in the South Fork Lost Soup Subunit from the 28 percent established by road restrictions in the Middle Soup Creek project to 25 percent.. All timber harvest alternatives proposed in the South Fork Lost Creek Project would maintain or slightly decrease Total Road Density, and Security Core Habitat. Hiding Cover would be decreased as described earlier in this chapter. Under all action alternatives except Alternative E, the existing bridge over Cliff Creek (in T24N; R16W; S18) would be removed and replaced with a portable bridge which has the option of being removed for subsequent use at other sites. The removal of this bridge is not currently planned in the South Fork Lost Creek Timber Sale. This road would be rendered impassible with concrete barriers in an effort to reduce total road density.

b) Gray Wolf

i) Effects of Alternative A

Under the no action alternative, no changes from the current condition would be expected with regard to wolf recovery. No effects to wolves would be expected under this alternative. Should wolves show up in the project area, risks to wolves caused by wolf-human interactions would be lowest under this alternative.

ii) Effects of Alternatives B, C, D and E

The South Fork of Lost Creek drainage is a narrow, steep-sided valley with numerous rock outcrops. Most of the project area occurs on northerly

aspects and in winter supports low densities of mule deer, elk and moose. Low prey densities throughout the year and rugged topography that makes hunting difficult are factors that make the project area unlikely to be important for recovering wolves. None of the alternatives would be likely to further diminish the area's suitability for wolves. Nonetheless, dispersing wolves could show up in the project area at any time. Should wolves be detected during harvest operations, the DNRC Forest Management Bureau Biologist would be promptly notified, and appropriate mitigations would be developed and implemented.

iii) Cumulative Effects

Should wolves show up in the project area, any increase in road abundance and reduction in cover could cause additional cumulative risks to wolves by creating a greater potential for human-wolf interactions. However, additional risks associated with this project are expected to be low because of limited habitat quality and difficult public access across much of the project area.

c) Bald Eagle

i) Effects of Alternative A

No effects to bald eagles would be expected to occur should this alternative be selected.

ii) Effects of Alternatives B, C, D, and E

No known nesting pairs of eagles occur within 2.5 miles of the project area. Thus, activities associated with this project would not influence nesting eagles. No documented roost sites are near the project area boundary. The project area also lies about three miles distant from potential nesting habitat along the Swan River. Bald eagles are not known to winter in the project area, and timber harvesting would not be expected to affect migration behavior of eagles. Therefore, effects to eagles that would result from this project are not expected.

iii) Cumulative Effects

Suitable nesting and foraging habitat does not occur within several miles of the project area. Therefore, no cumulative effects on eagles are anticipated to result from activities associated with this project.

d) Peregrine Falcon

i) Effects of Alternative A

No change from the current condition would occur under this alternative, nor would other long-term changes to habitat or habitat potential occur. Thus, effects to peregrine falcons would not be expected to occur should this alternative be selected.

ii) Effects of Alternatives B, C, D and E

Actions associated with this project could disrupt the activities of nesting peregrines should they occur in the project area. Because Swan Lake, the Swan River National Wildlife Refuge and the Swan River all lie within about 4-6 miles of cliff habitat found in the project area, it is possible that peregrines could use the project area. Although it is unknown for certain, these areas collectively may possess enough open country and water to provide ample feeding opportunities for a nesting pair of falcons, should a pair choose to nest in the area. Peregrines, however, have high fidelity to previous nesting sites and rarely seek out new areas. Overall, the quality of nesting habitat in the project area is low due to the long distance to favorable feeding habitat. Also, snow frequently lingers on cliff features that offer potential nesting sites within the project area, which would also not promote nesting by peregrines. We believe it unlikely that peregrines would choose to reside in the project area, however, it is possible that they could show up there. Should a nesting pair of peregrines be located in the project area or nearby vicinity, a DNRC biologist would be promptly notified, and mitigations that would limit disturbance would be developed and implemented. Activities associated with this project would not be expected to influence migrating peregrine falcons.

iii) Cumulative Effects

Activities that would affect habitats important for peregrine falcons are not expected to occur under any of the alternatives considered. Thus, no localized or cumulative impacts to peregrine falcons are expected to occur as a result of this project.

2. Sensitive Species

a) Black-backed Woodpecker

i) Effects of Alternative A

As there are no recent burns on the project area, we would expect neither improvement or degradation of habitat for black-backed woodpeckers should this alternative be selected. This alternative would maintain the greatest acreage of stands in a condition prone to stand-replacement fires. Therefore, this alternative would maintain the greatest nesting and feeding habitat capability should a large burn occur.

ii) Effects of Alternatives B, C, D and E

Within the project area on DNRC ownership there exists about 2,306 acres of mature forest with overhead crown closure of greater than 40%. These acres would likely provide suitable feeding and nesting habitat (albeit to varying degrees) following large intense fire events. Acreages of potential habitat would be reduced by the amount proposed for harvest under each alternative (B-523, C-607, D-514, and E-254 acres). Harvest proposed under each alternative would vary in the degree that they would actually reduce the risk of stand replacement fire events, but successful ignition and spread of fire is based on numerous factors and would be difficult to predict with accuracy.

iii) Cumulative Effects

Treatments that reduce the acreage of stands that would provide conditions for intensive fire events and reduce suitable habitat should a burn occur, would cause an indirect cumulative reduction in habitat potentially usable by black-backed woodpeckers in the future.

b) Boreal Owl

i) Effects of Alternative A

Under this alternative, no near-term changes to boreal owl habitat would occur. Thus, no effects, either positive or negative would be expected on boreal owls. Should succession occur in the project area indefinitely in the absence of large, natural disturbances, regeneration of shade intolerant tree species important for nesting owls would be inhibited; thus adverse impacts would be expected.

ii) Effects of Alternatives B, C, D, and E

Under all of the action alternatives, habitat usable by boreal owls would be reduced by varying degrees due to timber harvest (Tables 4-18 and 4-19; Figures 4-13 thru 4-16). Snags and structural attributes within harvested older forests would be reduced below levels believed to have, at least, seasonal importance for borealS. All snags would be retained except for those inadvertently lost during harvest activities or removed for human safety reasons. However, the overall net reduction of snags would be expected to reduce near-term nesting opportunities for boreal owls.

Shade intolerant reserve trees that would remain following harvest would help to maintain future nesting opportunities on site. Tree amounts left in reserve would meet or exceed those specified under current SFLMP Biodiversity Guidance. However, overall abundance of mature trees would be reduced; thus, current nesting opportunities would also be reduced by proportional amounts. Harvest units emulating stand-replacement disturbances (moderate and light reserve treatments) would promote the development, and maintain the presence of shade intolerant tree species that would be expected to provide nesting opportunities for owls in 100-200 years.

On treated sites, coarse woody debris would occasionally be altered structurally and reduced below current amounts, which could reduce the

abundance and availability of habitat for important prey species, such as red-backed voles. Also, removal of mid-level and overstory canopy would cause the subsequent increase in snow depths and crusting on treated sites that could make acquisition of prey more difficult for owls on harvested sites (Hayward 1994). Old growth retention amounts in the cover type considered of primary importance for boreal owls (subalpine fir cover type) would remain at levels greater than those expected to occur under average historical conditions on DNRC ownership following treatments under all action alternatives (see Vegetation Analysis section for additional detail). Therefore, we believe that the needs of boreal owls would generally be met across the SRSF to the extent that DNRC ownership is capable of providing for owls.

iii) Cumulative Effects

Timber harvesting as proposed under all of the action alternatives would cause reductions in suitable habitat for boreal owls. Such reductions would be cumulative in effect with similar past, and ongoing reductions caused by management on DNRC and neighboring ownerships. To the extent that harvest activities associated with this project would reduce habitat, they could potentially contribute regional declines in boreal owl numbers.

TABLE 4-18. EFFECTS OF PROPOSED TIMBER HARVESTING ON ACRES OF EXISTING BOREAL OWL HABITAT >5,200 FEET ON THE SOUTH FORK LOST CREEK PROJECT AREA.

	Existing Cond.	Alt. B	Alt. C	Alt. D	Alt. E
Acres Stands Mature Sawtimber (100-149 yrs.) with >40% Canopy Closure at >5,200 ft. in Elevation Following Treatment	311	221	108	305	305
Acres Stands >150 Years Old with >40% Canopy Closure at >5,200 ft. in Elevation Following Treatment	491	360	418	366	477
Total Acreage	802	581	526	671	782
% of DNRC Ownership in Boreal Habitat within Project Area Following Treatment	19	14	13	16	19

TABLE 4-19. EFFECTS OF PROPOSED TIMBER HARVESTING ON ACRES OF EXISTING BOREAL OWL HABITAT >5,200 FEET ON THE SWAN RIVER STATE FOREST.

	Existing Cond.	Alt. B	Alt. C	Alt. D	Alt. E
Acres Stands Mature Sawtimber (100-149 yrs.) with >40% Canopy Closure at >5,200 ft. in Elevation Following Treatment	906	816	703	900	900
Acres Stands >150 Years Old with >40% Canopy Closure at >5,200 ft. in Elevation Following Treatment	2,968	2,837	2,895	2,843	2,954
Total Acreage	3,874	3,653	3,598	3,743	3,854
% of DNRC Ownership in Boreal Habitat on the SRSF	10	9	9	9	10

FIGURE 4-13. EFFECTS ON BOREAL OWL HABITAT (ALT B)

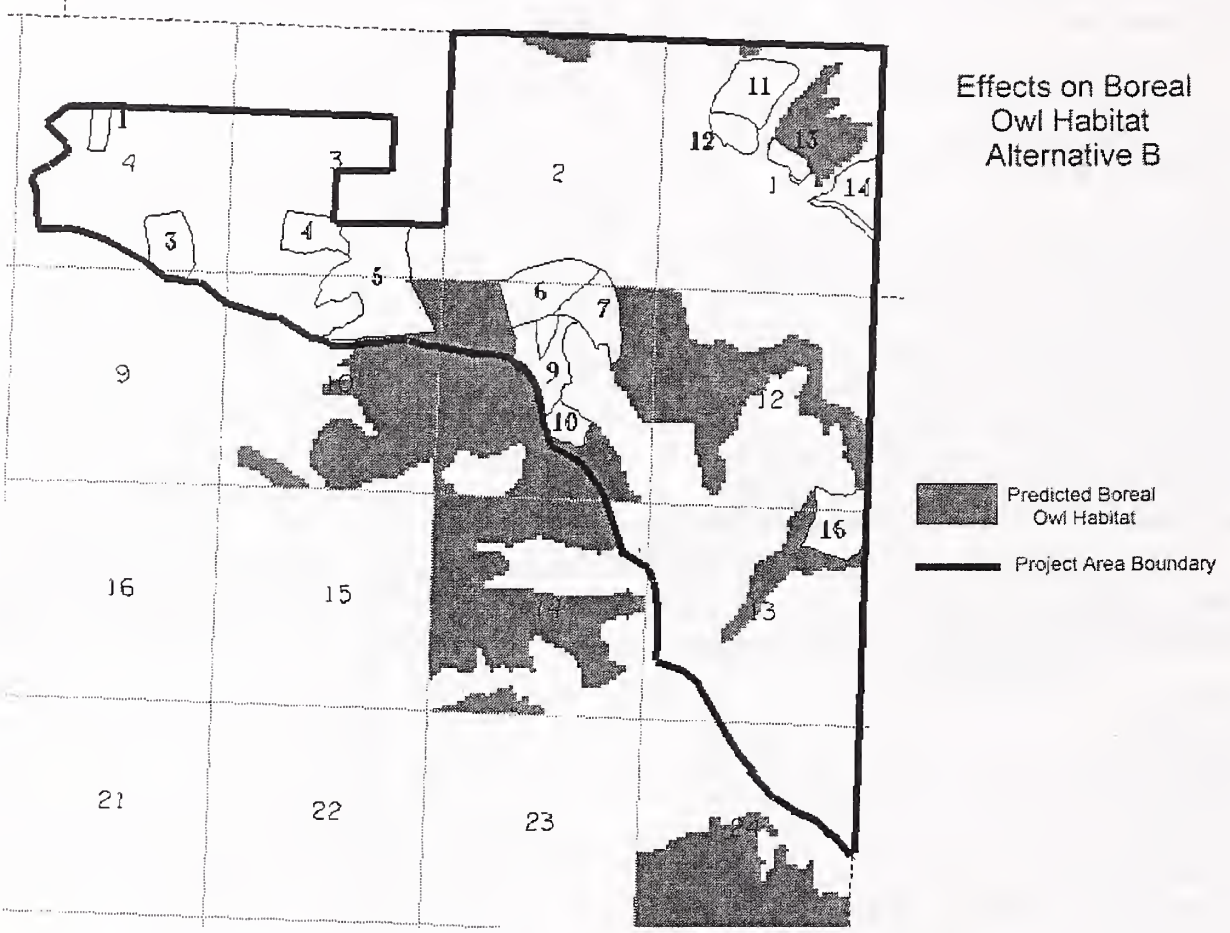


FIGURE 4-14. EFFECTS ON BOREAL OWL HABITAT (ALT C)

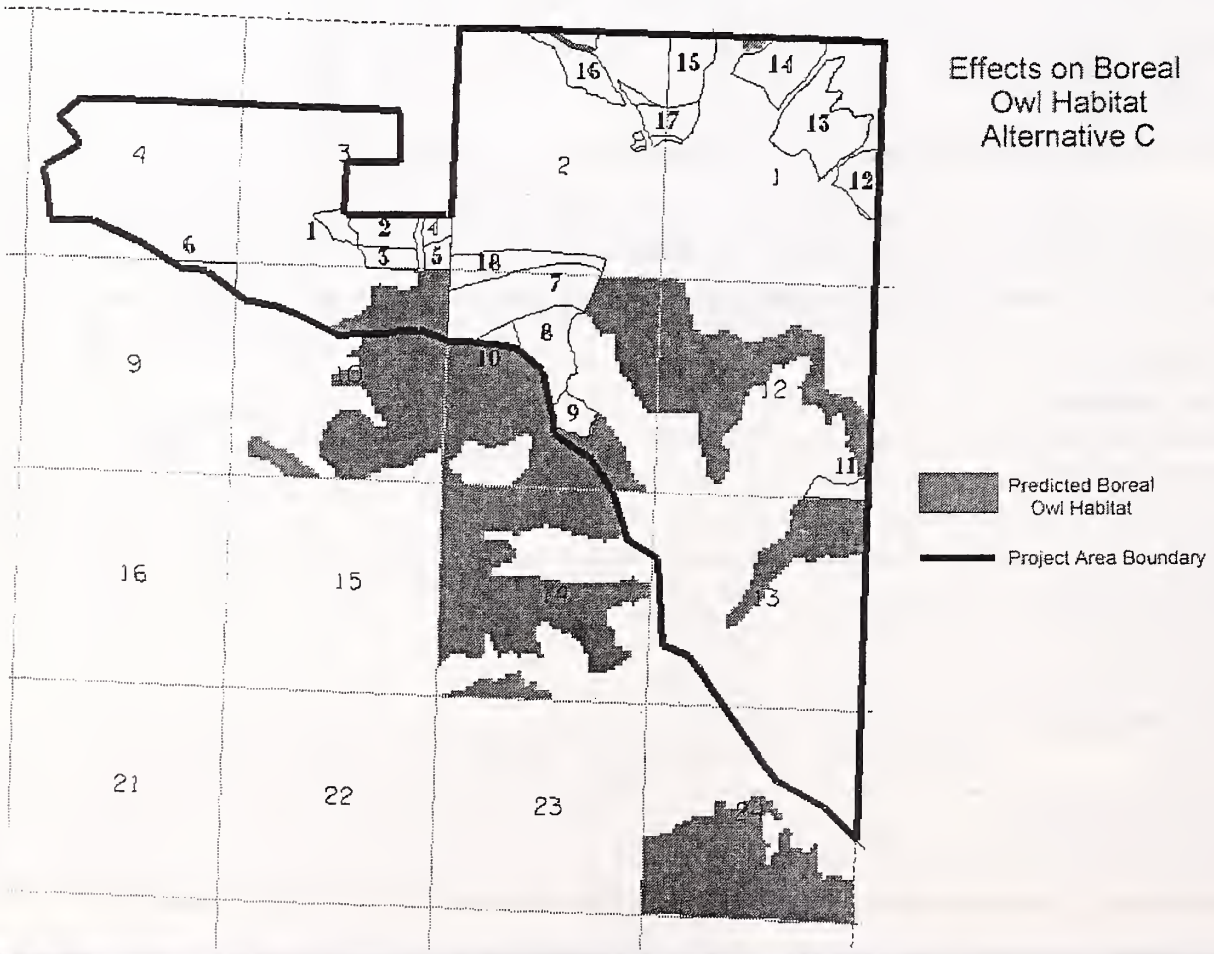


FIGURE 4-15. EFFECTS ON BOREAL OWL HABITAT (ALT D)

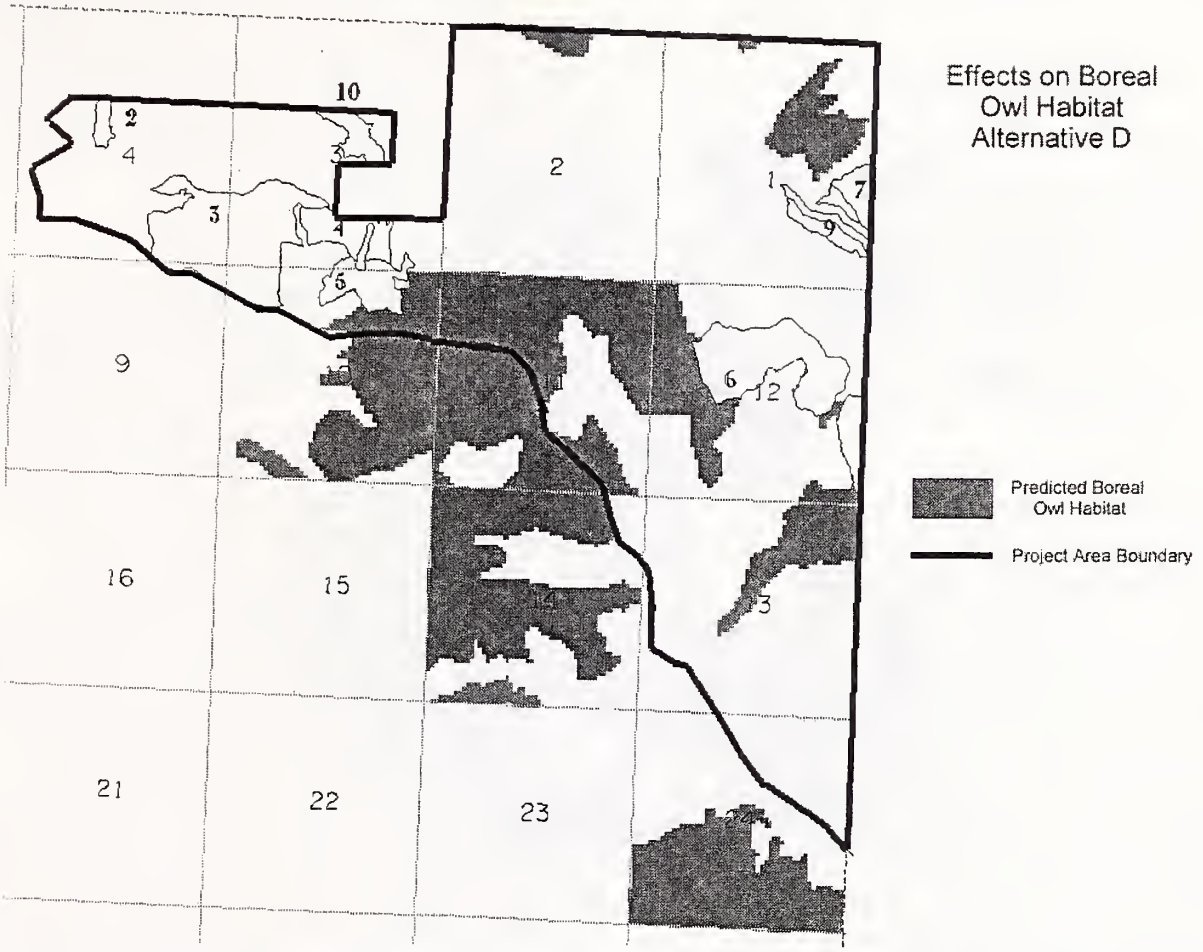
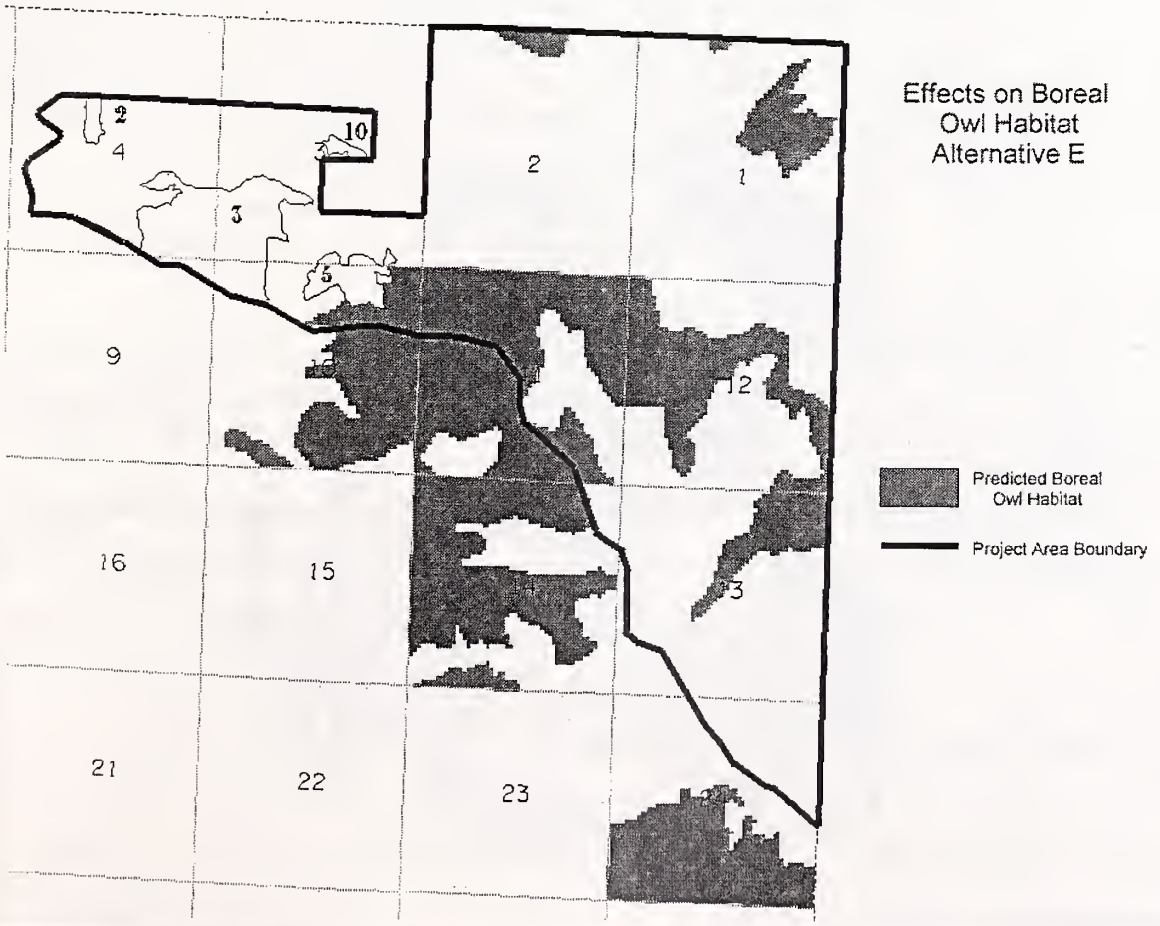


FIGURE 4-16. EFFECTS ON BOREAL OWL HABITAT (ALT E)



c) Fisher

i) Effects of Alternative A

Under this alternative forests would continue to age and develop attributes characteristic of older forests (assuming no large disturbance events would occur). Habitat, therefore, would be expected to improve for fishers over time.

ii) Effects of Alternatives B, C, D, and E

Under all of the action alternatives no harvest activity would take place within preferred fisher habitat within riparian zone buffers (Table 4-20 and Figure 3-11). Therefore, we would expect minimal impacts to fishers that might use these areas for foraging, traveling or resting. Fishers could, however, be disturbed and displaced temporarily from the vicinity of South Fork Lost Creek at the time harvest activities are taking place, especially along #680 during hauling. Long-term effects to fishers that might use the area would not be expected to occur from such disturbance. Additional roads constructed under each action alternative could increase access for trapping pressure within the confines of the project area. However, additional risks to fishers when considering the current situation would not be expected to be great, as Road #680 is open to year-round access at present.

Fisher populations may be limited by patch isolation associated with loss of overhead cover that provides security. Therefore, we mapped all patches within the South Fork Lost Soup BMU with >40% crown closure in pole-sized or greater stand size classes to visually assess landscape-level connectivity and distribution of cover. All action alternatives would reduce travel cover and structural attributes important for fishers to a varying degree proportional to the acreage and intensity of harvest (Table 4-21). However, maps depicting areas of travel cover and non travel cover (Figures 4-17 thru 4-20), suggest that although barriers exist that would be expected to limit movements of fishers under each alternative, none eliminate routes through which movement could occur across major drainage features found within the BMU. Thus, we do not anticipate substantial effects on fishers under any alternative.

TABLE 4-20. ACRES OF PREFERRED FISHER HABITAT WITHIN RIPARIAN CORRIDORS LOCATED ON THE PROJECT AREA AND ACROSS THE SOUTH FORK LOST SOUP BMU. NO HABITAT WITHIN FISHER BUFFERS WOULD BE AFFECTED BY ANY OF THE PROPOSED ACTION ALTERNATIVES. ACREAGE ESTIMATES PRESENTED HAVE BEEN CORRECTED FOR ROAD ACRES OCCURRING WITHIN FISHER BUFFERS.

	BMU	Project Area
Preferred Fisher Habitat Ac.	1,250	254
% Acres Within Riparian Buffer Zones	67	77

TABLE 4-21. AFFECTED ACRES ON DNRC OWNERSHIP OF CONTINUOUS COVER SUITABLE FOR MAINTAINING TRAVEL AND MOVEMENT OPPORTUNITIES FOR FISHERS IN THE SOUTH FORK LOST SOUP BMU.

	Current Cond.	Alt. B	Alt. C	Alt. D	Alt. E
Acres of Pole-sized or Greater Trees Maintaining >40% Crown Closure Following Treatment	12,048	11,655	11,571	11,545	11,800
% of DNRC Ownership Within BMU Existing in this Condition Following Treatment	66	63	63	63	64

FIGURE 4-17. EFFECTS ON PREDICTED FISHER TRAVEL COVER (ALT B)

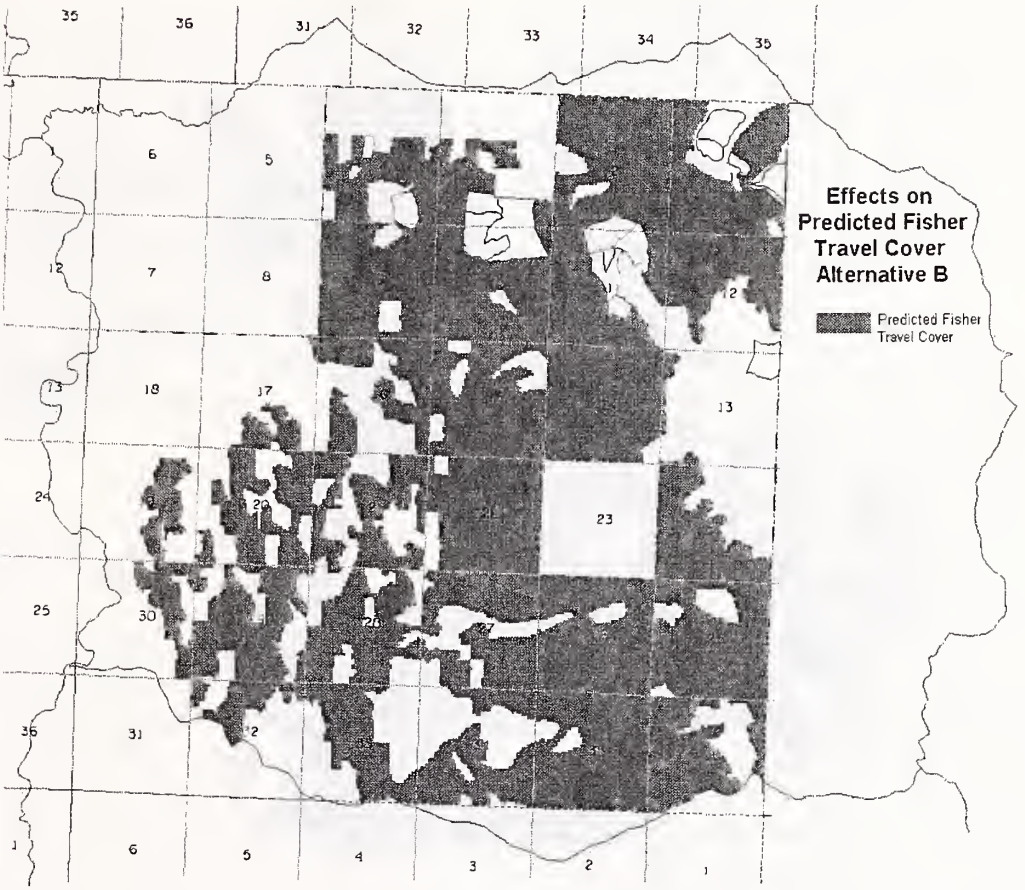


FIGURE 4-18. EFFECTS ON PREDICTED FISHER TRAVEL COVER (ALT C)

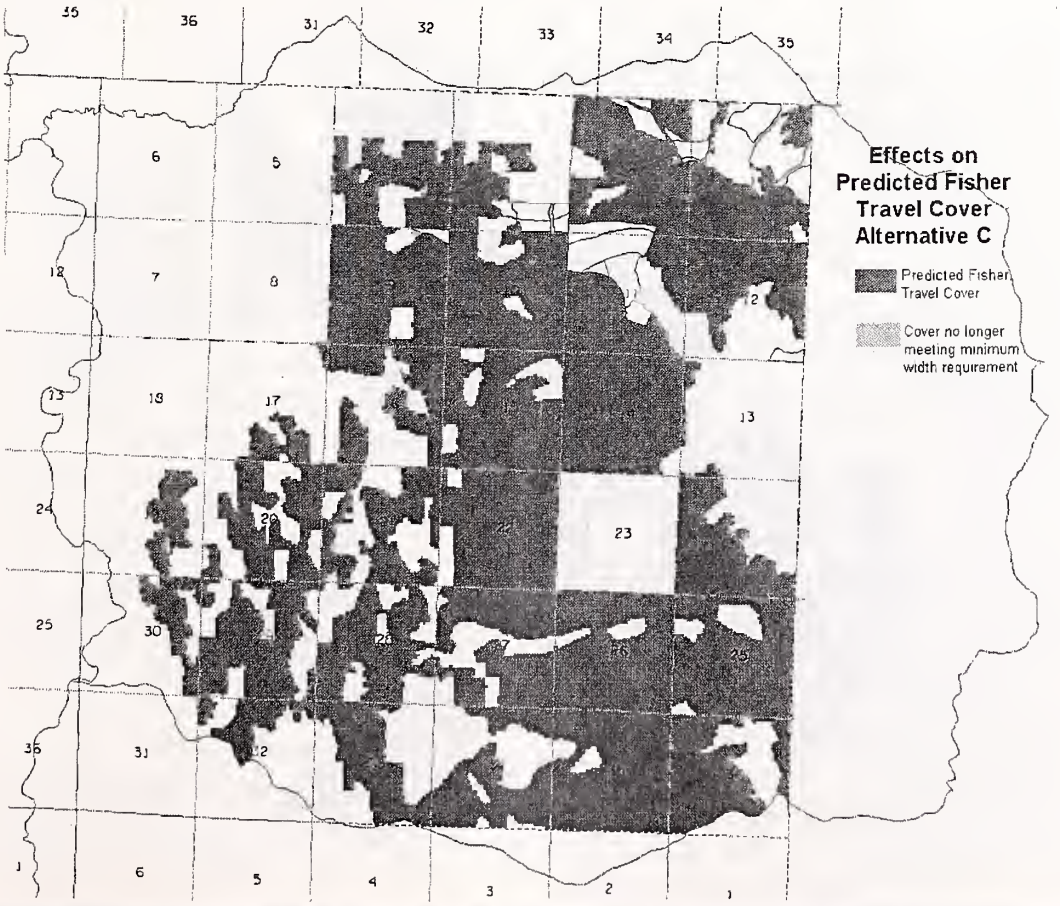

Effects on Predicted Fisher Travel Cover Alternative C
Predicted Fisher Travel Cover
Cover no longer meeting minimum width requirement

FIGURE 4-19. EFFECTS ON PREDICTED FISHER TRAVEL COVER (ALT D)

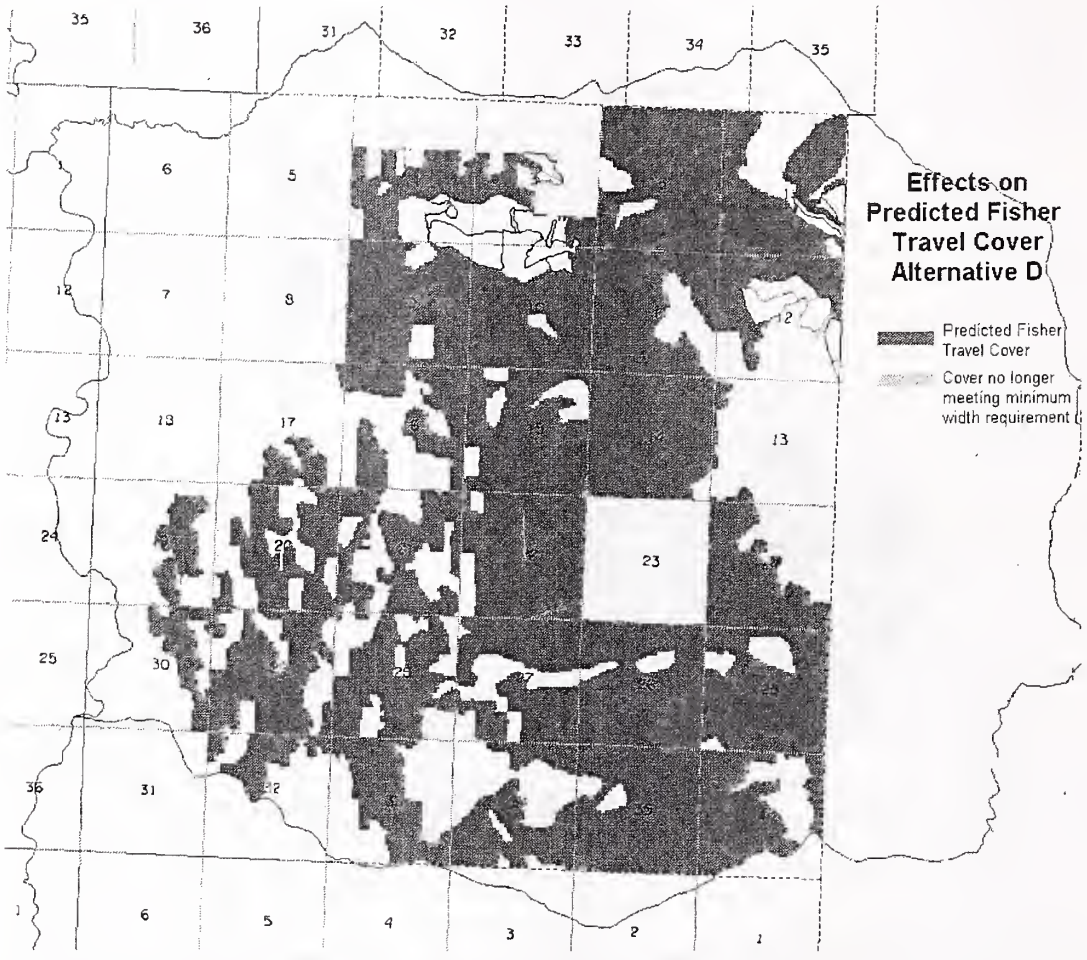
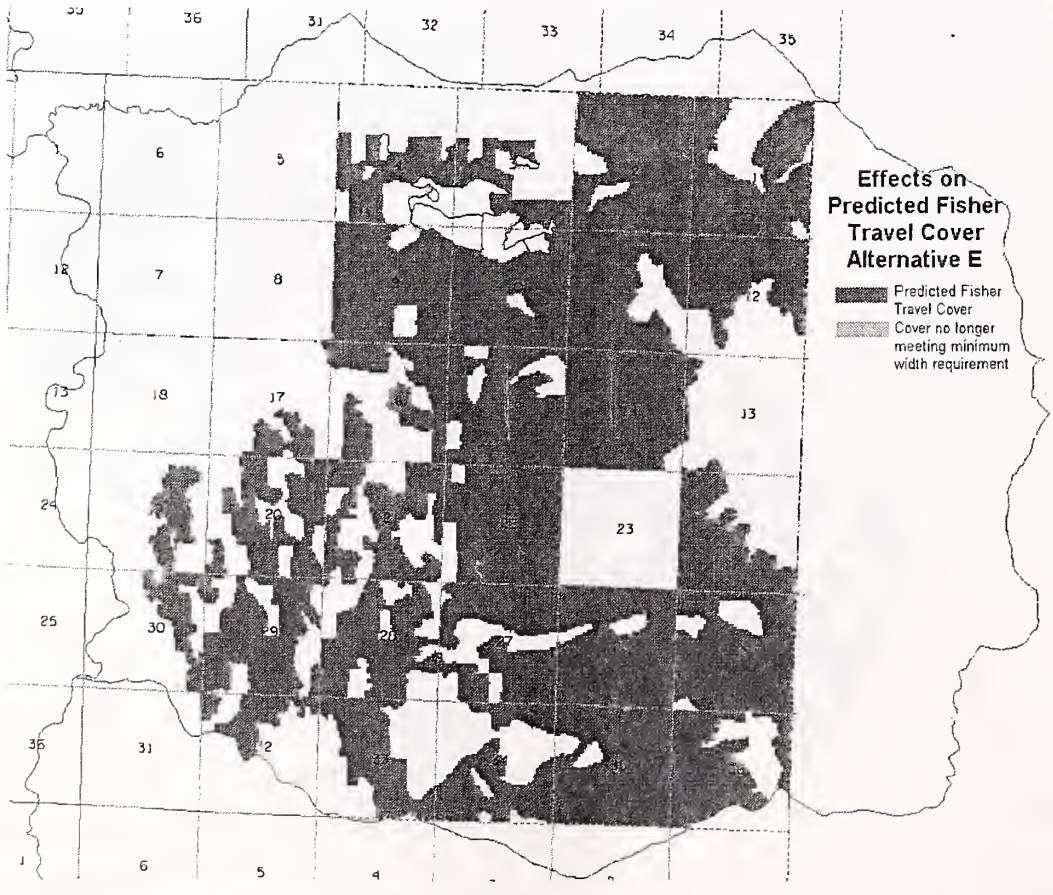


FIGURE 4-20. EFFECTS ON PREDICTED FISHER TRAVEL COVER (ALT E)



iii) Cumulative Effects

Timber harvest that would be associated with each action alternative would reduce tree density and attributes associated with old forests that are important for fishers. Forested patches that currently provide travel cover would also be removed, which could pose barriers to movement for fishers. Such habitat alterations would represent cumulative reductions in fisher habitat when considered in conjunction with similar past, and ongoing reductions caused by management on DNRC and neighboring ownerships.

d) Lynx

i) Effects of Alternative A

Under Alternative A there would be little immediate change to lynx habitat on the project area. Habitat attributes and structures associated with denning habitat would be expected to increase gradually as stands would age over time. However, young stands important for lynx foraging habitat would also mature within about 30-40 years, providing less-favorable conditions for snowshoe hares that are preferred prey for lynx. An abundance of denning habitat too distant from productive feeding areas would not be beneficial for lynx, and a reduction in habitat quality would be expected.

ii) Effects of Alternatives B, C, D and E

To assess effects of this project on lynx, we considered three broad habitat components considered important for local lynx populations: 1) old growth stands >150 years of age that were well-stocked and maintained high levels of coarse woody debris (denning habitat), 2) well-stocked sapling stands (feeding habitat), and 3) continuous patches of cover with >40% crown closure of pole-sized or greater size (travel cover). All proposed action alternatives would influence these habitat components for lynx to some degree.

Alternatives B, C, and D all include relatively high amounts of stand-replacement-type treatments. Immediately following harvest, these areas would likely be unsuitable for use by lynx because they would lack snowshoe hares, and usable cover for travel and denning. Feeding habitat acreages remain constant by alternative (Tables 4-22 and 4-23), however, following 10-30 years, some stand-replacement units would be expected to regenerate, providing more favorable conditions for foraging. Alternative E would provide little in the way of additional feeding habitat in the future, but would also alter travel habitat and denning habitat least.

Examination of SLI data suggests that a high percentage of the existing lynx denning habitat for the BMU occurs within the project area (~91%). Alternative D would affect the greatest amount of denning habitat of all the alternatives considered (Tables 4-22 and 4-23). While a relatively high level of denning habitat would remain following harvest (719 ac), some habitat likely providing denning opportunities at present would be reduced. Based on observed acreage estimates for denning and feeding habitat, it appears that lack of ample feeding habitat in close proximity to denning habitat may currently be limiting. Alternatives B, C, and D would emulate patchy fire disturbances of various intensity, and would improve the abundance over the next few decades of feeding habitat in close proximity to denning habitat for lynx.

Lynx movements may also be limited by patch isolation associated with loss of overhead cover that provides security. Therefore, we mapped all patches within the South Fork Lost Soup BMU with >40% crown closure in pole-sized or greater stand size classes to visually assess landscape-level connectivity and distribution of cover. All action alternatives would reduce travel cover and structural attributes important for lynx to varying degrees proportional to the acreages and intensities of harvest (Tables 4-22 and 4-23). However, maps depicting areas of travel cover and non travel cover (Figures 4-21 thru 4-24), suggest that although additional non-cover barriers would be created that would limit movements of lynx to a degree under each alternative, none would eliminate routes through which movement could occur across major drainage features found within the BMU. Thus, we do not anticipate substantial effects on lynx with regard to the alteration of habitat in a manner that would inhibit long movements under any of the action alternatives.

TABLE 4-22. EFFECTS ON ACRES OF LYNX HABITAT FOR THE SOUTH FORK LOST SOUP BMU.

BMU	Current Cond.	Alt. B	Alt. C	Alt. D	Alt. E
Travel Habitat	11,051	10,749	10,654	10,736	10,830
Denning Habitat	997	906	917	809	970
Feeding Habitat	1,093	1,093	1,093	1,093	1,093
Total	13,141	12,748	12,664	12,638	12,893
% Travel on DNRC in BMU	60	59	58	58	59
% Denning on DNRC in BMU	5	5	5	4	5
% Feeding on DNRC in BMU	6	6	6	6	6

TABLE 4-23. EFFECTS ON ACRES OF LYNX HABITAT FOR THE SOUTH FORK LOST TIMBER SALE PROJECT AREA.

Project Area	Current Cond.	Alt. B	Alt. C	Alt. D	Alt. E
Travel Habitat	1,777	1,475	1,380	1,461	1,556
Denning Habitat	907	816	827	719	880
Feeding Habitat	260	260	260	260	260
Total	2,944	2,551	2,467	2,440	2,696
% Travel on DNRC in Proj. Area	43	35	33	35	37
% Denning on DNRC in Proj. Area	22	20	20	17	21
% Feeding on DNRC in Proj. Area	6	6	6	6	6

iii) Cumulative Effects

Harvest influences would cumulatively reduce denning and travel habitat for lynx. However, both of these habitat components would likely remain in ample amounts following harvest under any of the action alternatives considered. Thus, we would expect no overall reductions in cover that would be limiting to lynx. Should further substantial reductions of cover occur within the BMU on DNRC or other ownerships where management is beyond our control, additional cumulative reductions in cover would be expected, some of which could be limiting to lynx. This would be unlikely in the near-term as DNRC manages a large proportion of this BMU and it will become an Inactive Subunit for bear management considerations in the year 2,000, at which time management activities in the area would be reduced.

As feeding habitat makes up a relatively small proportion of this subunit (~6%), we would expect a cumulative increase in feeding habitat created by stand-replacement units proposed under Alternatives B, C, and D following their successful regeneration. This would have a positive effect overall on lynx habitat quality in the BMU within several decades.

FIGURE 4-21. EFFECTS OF TIMBER HARVEST ON LYNX HABITAT (ALT B)

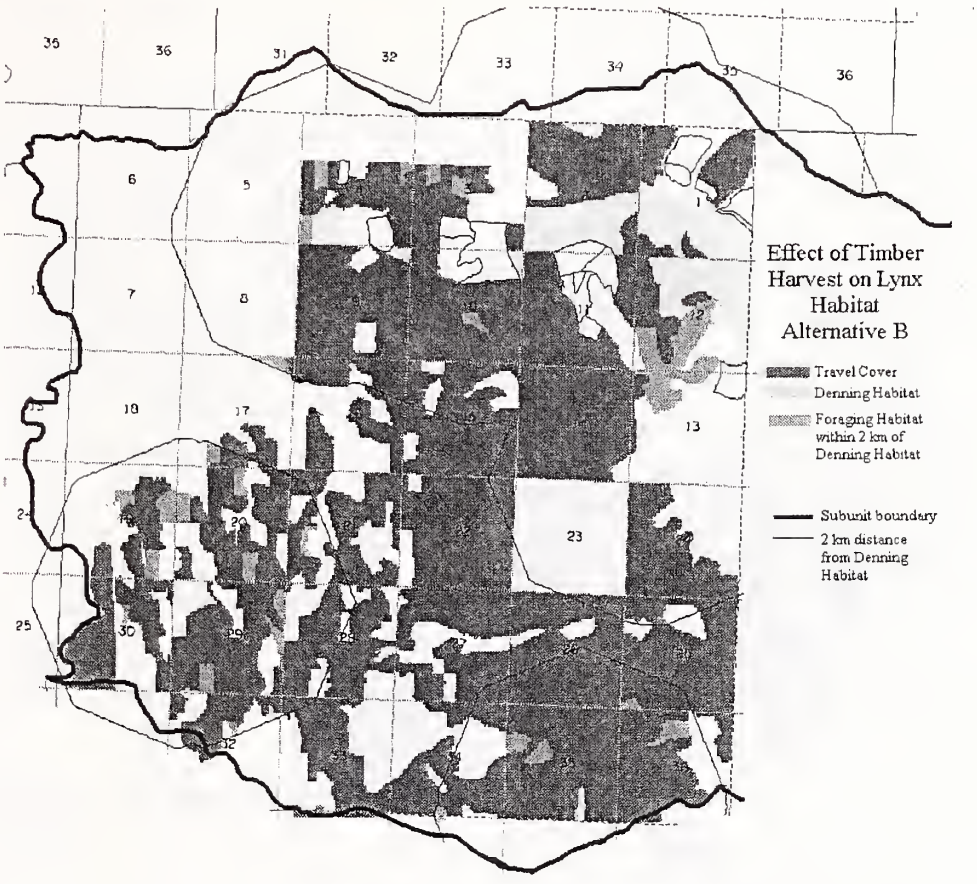

Effect of Timber Harvest on Lynx Habitat Alternative B
Travel Cover
Denning Habitat
Foraging Habitat within 2 km of Denning Habitat
Subunit boundary
2 km distance from Denning Habitat

FIGURE 4-22. EFFECTS OF TIMBER HARVEST ON LYNX HABITAT (ALT C)

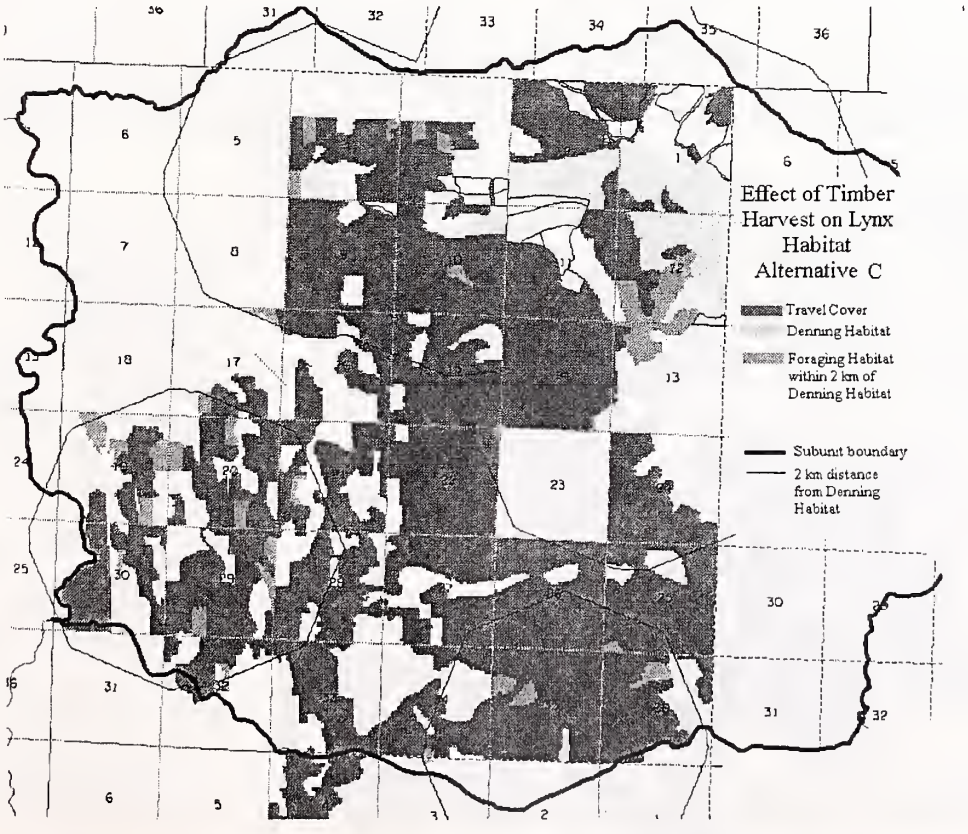

Effect of Timber Harvest on Lynx Habitat Alternative C
Travel Cover
Denning Habitat
Foraging Habitat within 2 km of Denning Habitat
Subunit boundary
2 km distance from Denning Habitat

FIGURE 4-23. EFFECTS OF TIMBER HARVEST ON LYNX HABITAT (ALT D)

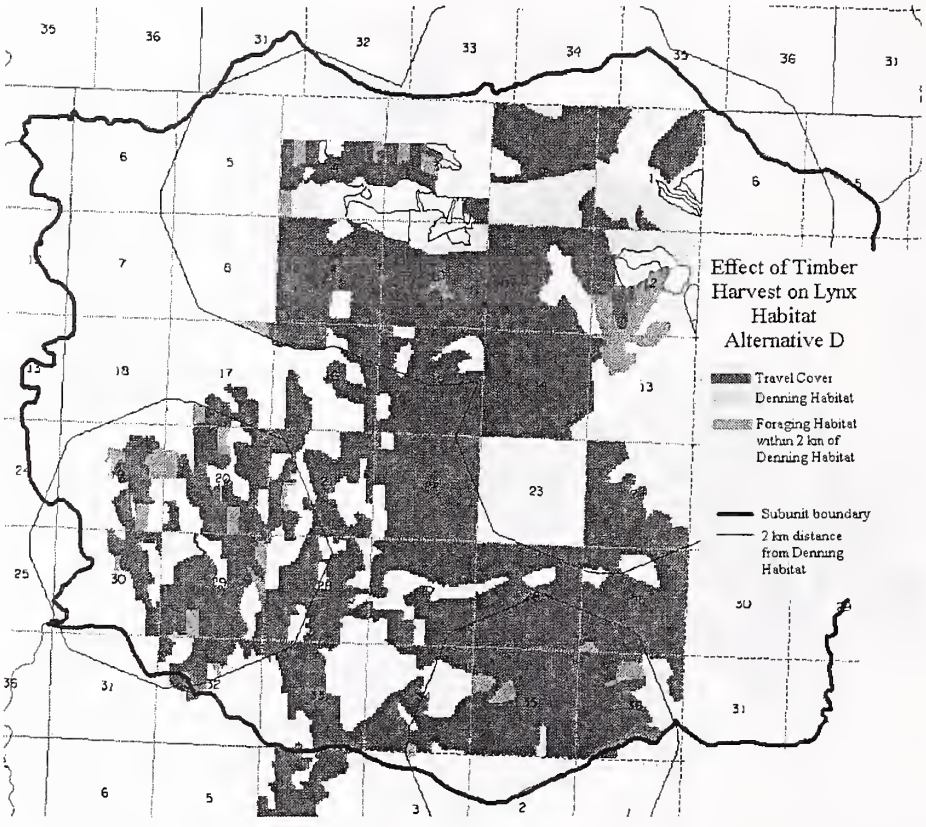
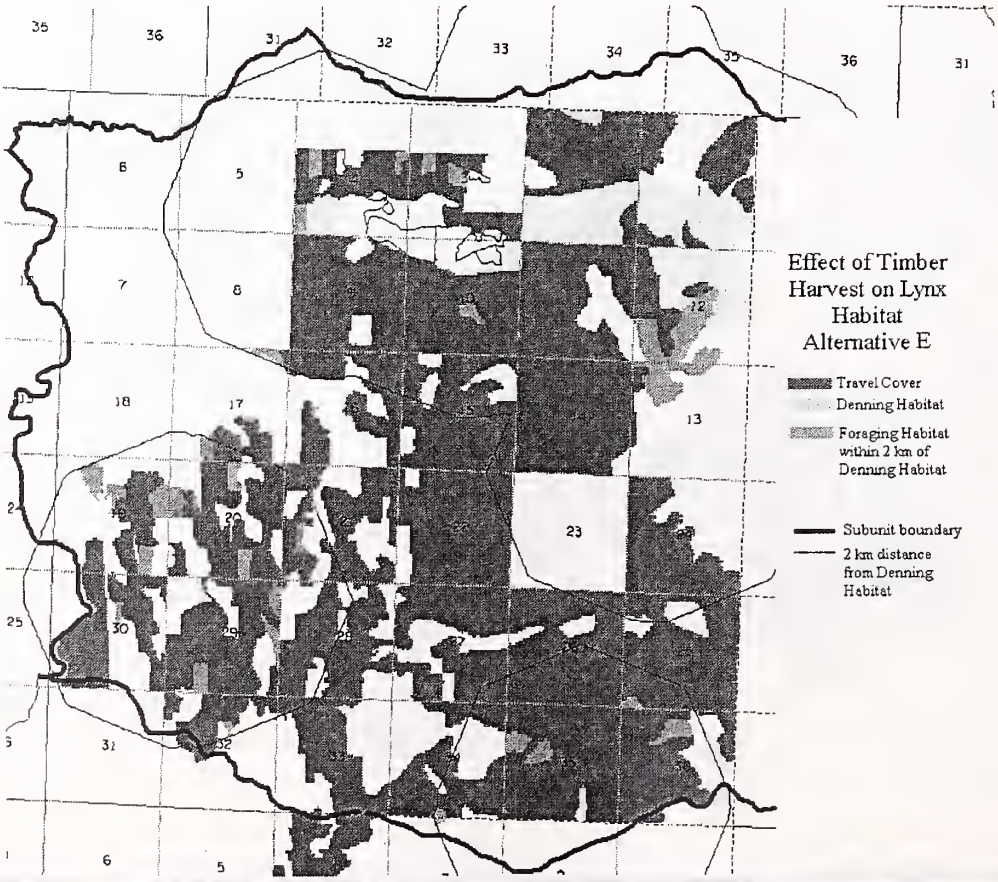

Effect of Timber Harvest on Lynx Habitat Alternative D
Travel Cover
Denning Habitat
Foraging Habitat within 2 km of Denning Habitat
Subunit boundary
2 km distance from Denning Habitat

FIGURE 4-24. EFFECTS OF TIMBER HARVEST ON LYNX HABITAT (ALT E)


Effect of Timber Harvest on Lynx Habitat Alternative E
Travel Cover
Denning Habitat
Foraging Habitat within 2 km of Denning Habitat
Subunit boundary
2 km distance from Denning Habitat

e) Pileated Woodpecker

i) Effects of Alternative A

Alternative A would leave currently high quality habitat intact for pileated woodpeckers within the project area. Old forests would remain intact, and attribute levels, such as snags and coarse woody debris would not be altered from their current condition. Over time snags and coarse woody debris amounts would increase, further improving nesting and foraging opportunities for pileated woodpeckers. Over the longer term, in the absence of large, natural fire or other disturbance events, the abundance of western larch and ponderosa pine would decrease as these species do not regenerate in shaded environments. As these tree species are preferred for nesting, their decrease over time would expectedly contribute to a subsequent reduction in habitat quality for pileated woodpeckers.

ii) Effects of Alternatives B, C, D and E

All of the proposed action alternatives would potentially reduce the quality of all of the units treated through the partial removal and/or alteration of attributes associated with older forests (such as snags, coarse woody debris, and multiple canopy structure). Refer to Figures 4-25 thru 4-28. Alternative E would cause the least short-term reduction in existing habitat (Table 4-24). Conversely, Alternative D would harvest the greatest acreage, and in a manner, that would be most likely to reduce near-term habitat quality for woodpeckers (Table 4-24). Alternatives B, C, and D would create the greatest acreage of young-aged forest (following successful regeneration), where shade-intolerant species could regenerate over the longer term. On units where prescribed fire would be applied, some reserve trees would likely be killed or injured that would create additional feeding opportunities for pileated woodpeckers. The extent of this occurrence is impossible to predict with the level of information currently available and likelihood of high variation in the outcome of proposed fire treatments.

Shade intolerant reserve trees would remain following harvest, which would help to maintain future nesting opportunities on site and promote regeneration. Tree amounts left in reserve would meet or exceed those specified under current SFLMP Biodiversity Guidance. However, overall abundance of mature trees would be reduced; thus, reducing current nesting and potentially feeding opportunities by proportional amounts. Thinning of mid and lower stories could cause pileated woodpeckers to avoid sites they might otherwise

TABLE 4-24. EFFECTS OF TIMBER HARVESTING ALTERNATIVES ON POTENTIAL PILEATED WOODPECKER HABITAT ON THE SOUTH FORK LOST TIMBER SALE PROJECT AREA.

	Current Cond.	Alt. B	Alt. C	Alt. D	Alt.E
Acreage of Moderate to Well-Stocked Forest 100-149 yrs. Old	665	480	454	613	640
Acres of Old Growth >150 yrs. with High Amounts of Large Trees >15 and >21 in. DBH	724	522	526	435	593
Acres of Old Growth >150 yrs. with Many Large Trees and 10% W. Larch, and/or Ponderosa Pine, and/or Blk. Cottonwood Dominants	910	804	844	758	827
Total Acres Potential Habitat	2,299	1,806	1,824	1,806	2,060

use for nesting and/or could reduce nesting success of fledglings. Thus, habitat quality would be reduced.

By providing a diversity of stand densities across the South Fork Lost Project Area, the potential for broad-scale stand replacement fire events would be reduced. Should a major fire burn through the area, sites that have been previously thinned would have a greater probability of survival, and some large, live trees would likely survive. This could have important implications for retaining long-term nesting potential on a landscape.

iii) Cumulative Effects

Proposed harvest units under all action alternatives would potentially reduce the quality of all of the units treated through the partial removal and/or alteration of attributes associated with older forests (such as snags, coarse woody debris, and multiple canopy structure) in the near term. Any such reductions would be cumulative to similar reductions that have previously occurred across the Swan Valley. Partial thinning, however, may be beneficial cumulatively for buffering the effects of large, natural disturbances that can kill future nest trees across a wide area (M. Hillis, USFS, Lolo Nat. For. Pers. Comm. 1997).

FIGURE 4-25. EFFECTS ON PILEATED WOODPECKER HABITAT (ALT B)

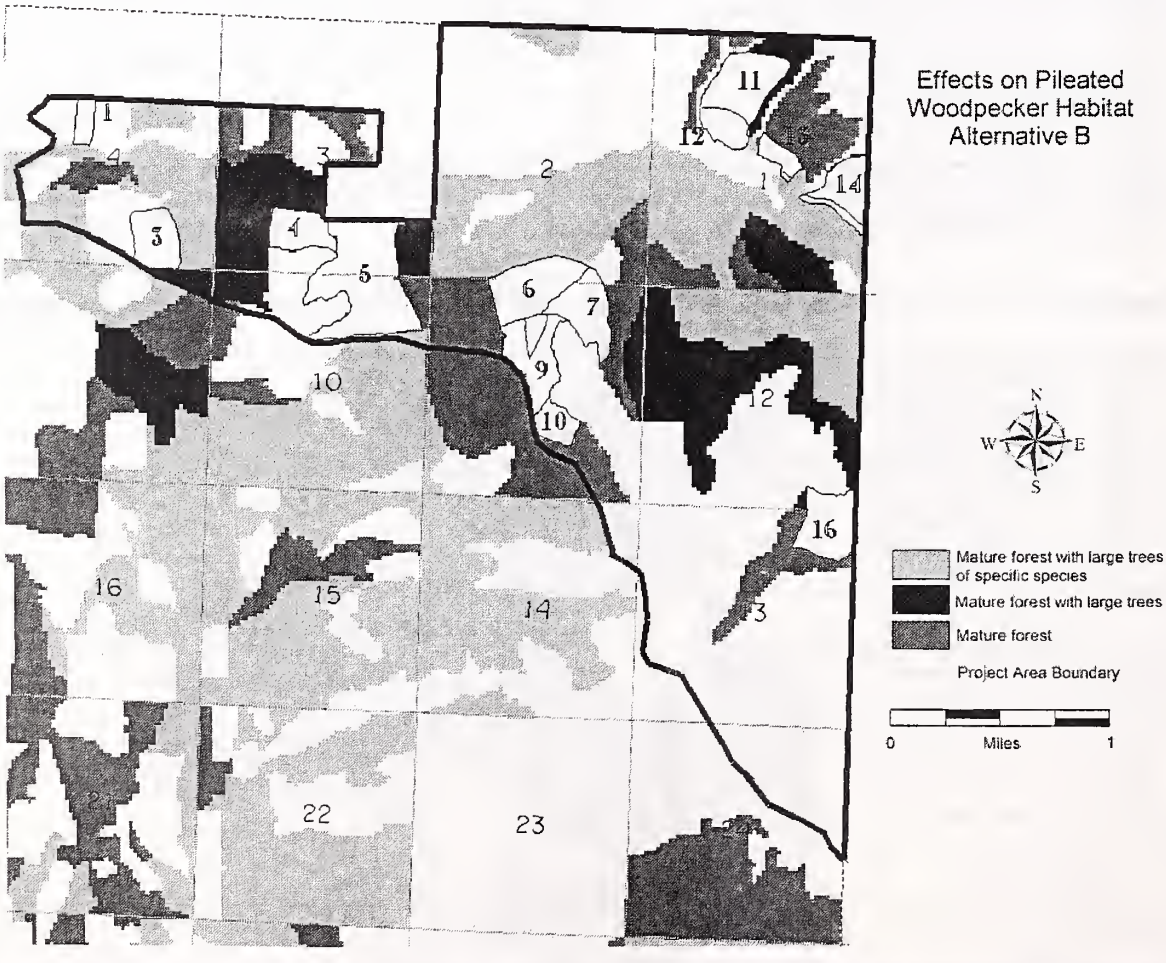


FIGURE 4-26. EFFECTS ON PILEATED WOODPECKER HABITAT (ALT C)

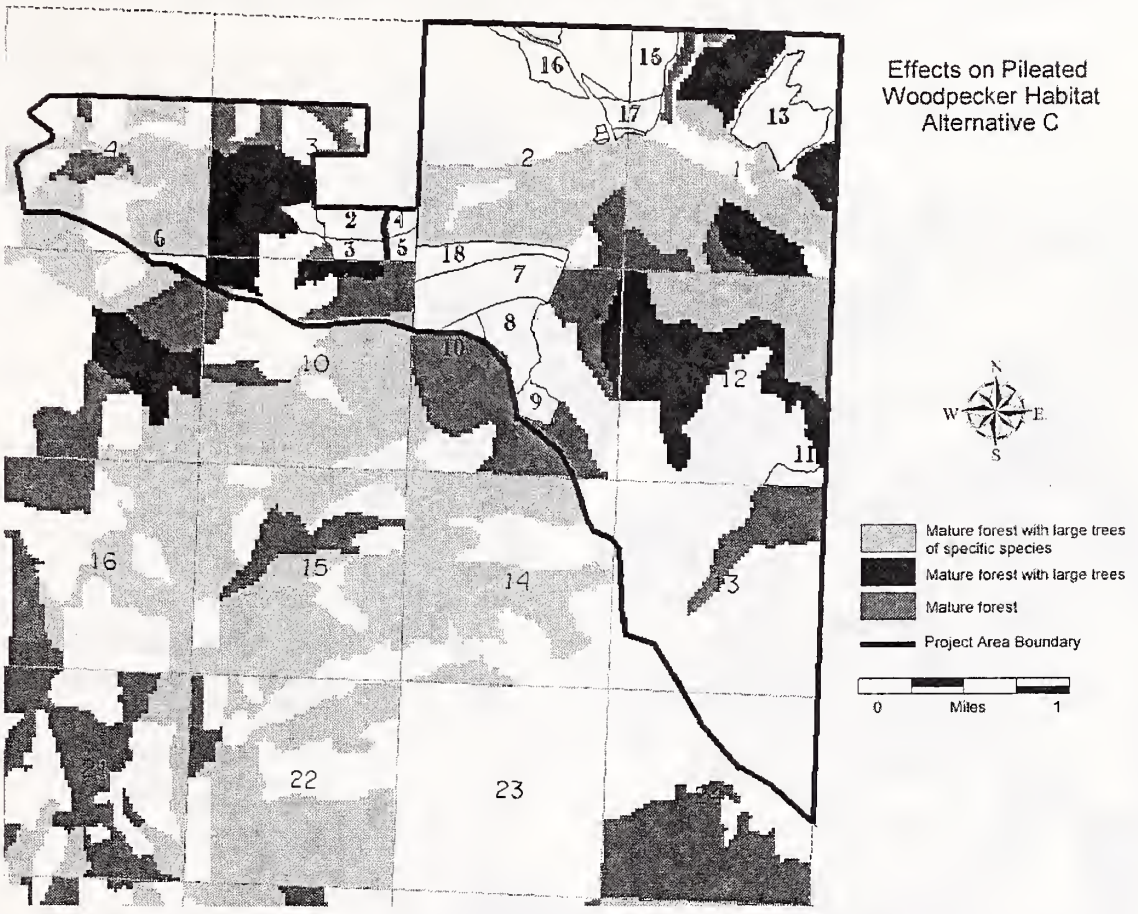


FIGURE 4-27. EFFECTS ON PILEATED WOODPECKER HABITAT (ALT D)

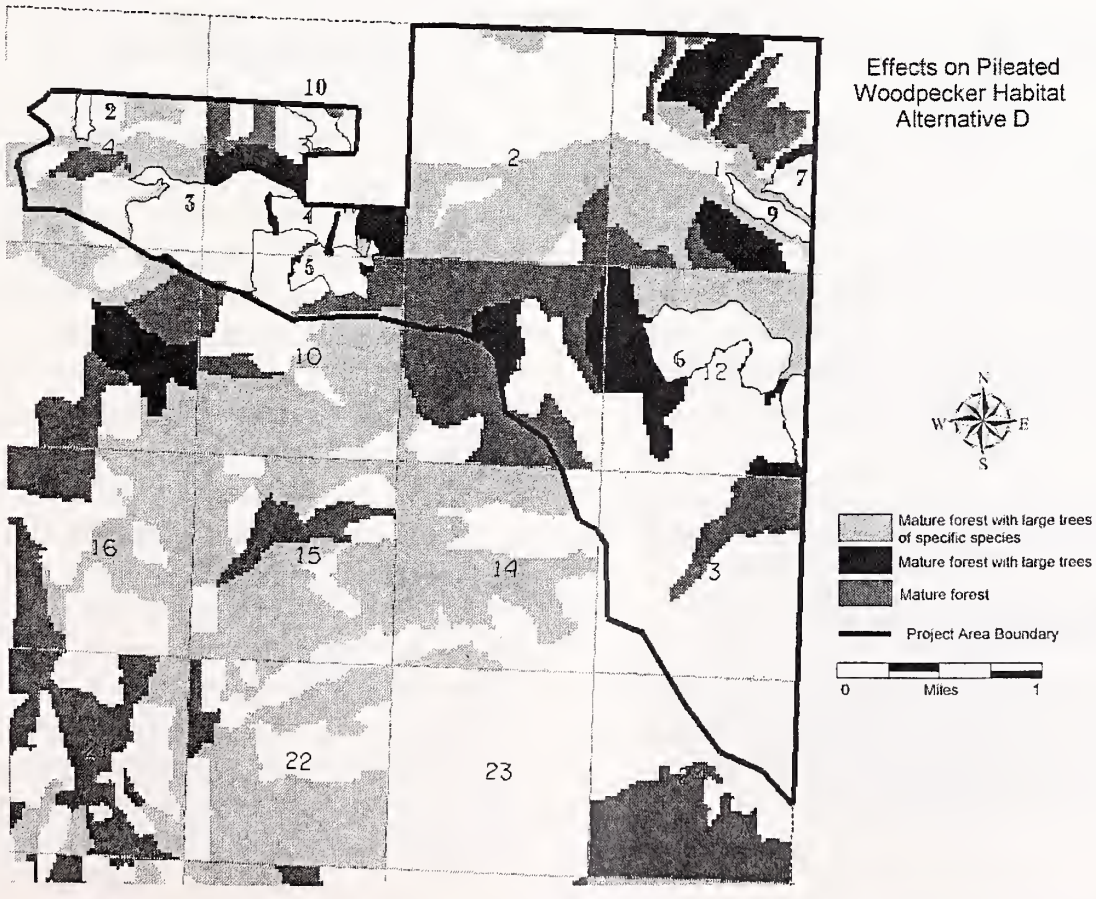
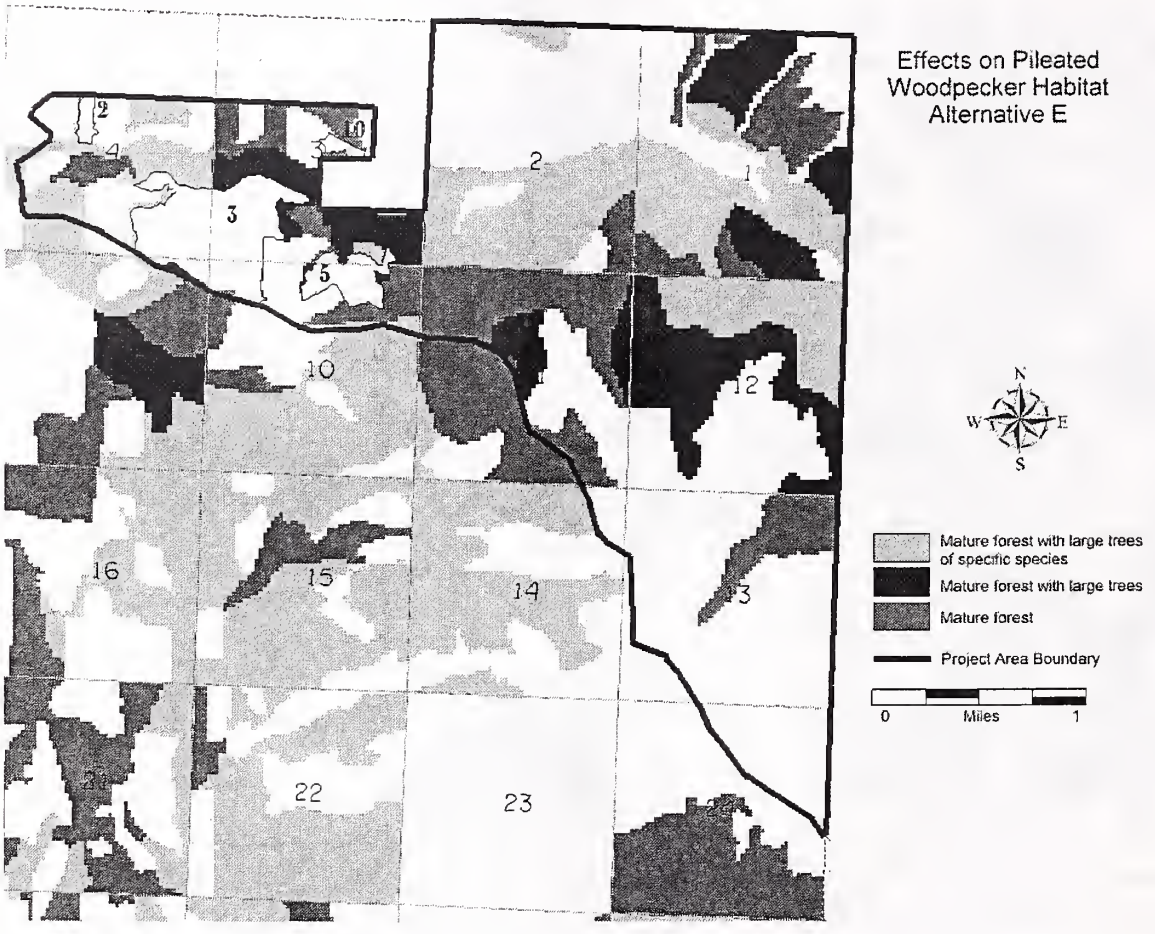


FIGURE 4-28. EFFECTS ON PILEATED WOODPECKER HABITAT (ALT E)



3. *BIG GAME*

Big game species included in this analysis include elk and mule deer. A Habitat Effectiveness (HE) coefficient, the amount of security habitat in the project area, and the amount of winter thermal cover on identified winter ranges were used to assess the impacts of different alternatives on elk and mule deer habitat. Derivation of the HE and definitions of security and thermal cover are given in Chapter 3.

All harvest units, regardless of treatment intensity, are assumed to lose their value as hiding and summer thermal cover as a result of harvesting. The analysis area for big game is coterminous with the project area (4,162 acres). Of this 4,162 acres, 3,492 currently qualify as hiding cover and 3,009 as summer thermal cover. Cattle would remain absent under all alternatives.

a) Habitat Effectiveness

i) Effects of Alternative A

Under Alternative A, hiding cover would remain at approximately 84 percent (3,492 acres) of the project area, and summer thermal cover would continue to cover about 72 percent (3,009 acres). Standardized open road density would remain at 0.51 miles per square mile, continuing the current 75 percent HE in the project area.

ii) Effects of Alternative B

Hiding and summer thermal cover would be reduced by about 525 acres leaving 71 percent (2,966 acres) of the project area in hiding cover and 60 percent (2,483 acres) in summer thermal cover. Use of currently restricted roads and building of new roads would increase the standardized road density in the project area to 0.70 miles per square mile. This would result in a HE estimate of 68 percent.

iii) Effects of Alternative C

Hiding and summer thermal cover would be reduced by about 607 acres leaving 69 percent (2,888 acres) of the project area in hiding cover, and 58 percent (2,405 acres) in summer thermal cover. Standardized road density would increase in the project area to 0.65 miles per square mile reducing HE to 70 percent.

iv) Effects of Alternative D

Hiding and summer thermal cover would be reduced by about 512 acres, leaving 72 percent (2,980 acres) of the project area in hiding cover and 60 percent (2,507 acres) in summer thermal cover. Use of currently restricted roads and building of new roads would increase the standardized road density in the project area to 0.65 miles per square mile. This would result in a HE estimate of 70 percent.

v) Effects of Alternative E

Hiding and summer thermal cover would be reduced by about 252 acres, leaving 78 percent (3,239 acres) of the project area in hiding cover and 66 percent (2,765 acres) in summer thermal cover. Use of currently restricted roads and building of new roads would increase the standardized road density in the project area to 0.62 miles per square mile. This would result in a HE estimate of 71 percent.

b) Elk and Mule Deer Winter Range

i) Effects of Alternatives A and C

No timber harvesting would occur on the elk and mule deer winter ranges in the project area that were defined by DFWP. Winter thermal cover would remain at 169 acres, 47 percent of the 359 acres of identified winter range in the project area.

ii) Effects of Alternatives B

This alternative would harvest 27 acres of winter thermal cover from the winter range area defined by DFWP. Approximately 141 acres (39 percent of the total 359 acres) of winter range would remain in thermal cover. There would be a decline in existing winter thermal cover by about 16 percent. The largest of the four thermal cover patches (about 23 acres) would remain intact.

iii) Effects of Alternatives D

This alternative would harvest 41 acres of winter thermal cover from the winter range area defined by DFWP. Approximately 127 acres (36 percent of the total 359 acres) of winter range would remain in thermal cover. There would be a decline in existing winter thermal cover by about 25 percent.

iv) Effects of Alternatives E

This alternative would harvest 27 acres of winter thermal cover from the winter range area defined by DFWP. Approximately 141 acres (39 percent of the total 359 acres) of winter range would remain in thermal cover. There would be a decline in existing winter thermal cover by about 16 percent.

c) Elk Security

i) Effects of Alternative A

Under Alternative A, 36 percent of the project area (1,489 acres of the total 4,162) would remain elk security habitat (defined in Chapter 3).

ii) Effects of Alternatives B

Increases in open and closed roads, and harvest would reduce elk security habitat to approximately 1,238 acres (30 percent of the project area).

iii) Effects of Alternatives C

Increases in open and closed roads, and harvest would reduce elk security habitat to approximately 1,310 acres (31 percent of the project area).

iv) Effects of Alternatives D

Increases in open and closed roads, and harvest would reduce elk security habitat to approximately 1,246 acres (30 percent of the project area).

v) Effects of Alternatives E

Increases in open and closed roads, and harvest would reduce elk security habitat to approximately 1,400 acres (34 percent of the project area).

d) Cumulative Effects on Big Game

The Middle Soup timber sale will not contribute to cumulative effects on big game species in the South Fork Lost Creek Drainage per se because it does not overlap the South Fork Lost Creek project area. However, proposed increases in roads and timber harvesting in both sales would potentially remove security cover that could adversely affect wide-ranging elk over a broader area. Open road density decreased overall when roads were closed in conjunction with the Middle Soup sale.

All action alternatives would reduce habitat effectiveness for elk from its existing 75 percent. However, none would reduce HE below 68%. Such reductions would be cumulative to other similar management activities in the area, but actual cervid/habitat interactions may vary. In a drainage such as South Fork Lost Creek, spring habitat quality may be low due to extensive acreages of closed canopy forest that limits access to forage, while fall security habitat during hunting season would be good. We expect that habitat diversity within the project area would be increased under any of the action alternatives, which would be positive for species that use a broad range of habitats, such as elk and mule deer. Overall, we expect there to be positive cumulative benefits for elk and deer should any of the action alternatives be selected.

VI. WATERSHED

A. *WATER QUALITY*

The primary effect of forest management practices on water quality is sediment delivery to streams. Sediment is generated by road construction and use, especially from roads constructed along or across streams. Timber harvest in or near riparian areas also can reduce the filtering capacity normally provided by vegetation in these areas. None of the alternatives would harvest timber in riparian areas. The harvest activities proposed in all timber harvest alternatives would fully comply with BMP and the Montana SMZ law to minimize the risk of increased sedimentation from harvest units. No harvesting would occur in an SMZ under any alternative. DNRC has agreed to implement the immediate actions for bull trout restoration recommended by the Governor's Bull Trout Restoration Team. We are surpassing the requirements of the SMZ law by incorporating martin/fisher no-harvest buffers of 50 meters on each side of perennial streams and 25 meters on each side of intermittent streams.

1. Effects Common to all Timber Harvest Alternatives

No alternative would harvest timber in a Streamside Management Zone. A 1.7 mile portion of the South Fork Lost Creek road would be permanently closed and the roadbed rehabilitated. This portion of road would be replaced with 1.7 miles of new road up the slope and away from the creek. The bridge over Cliff Creek and the two bridges over the South Fork Lost Creek are potential sources of sediment and would be replaced under all harvest alternatives, except Alternative E. Surface drainage features would be installed on approximately 10.3 miles of road in the South Fork Lost Creek watershed to bring them up to current BMP standards. Short-term increases in sediment and turbidity might result from these proposed activities, but they would lead to a net long-term benefit to water quality by stabilizing existing sources of sediment and improving surface drainage and potential for sediment delivery.

2. Effects of Alternative A

Under the no-action alternative, no new roads would be constructed and no timber would be harvested in the South Fork Lost Creek watershed. None of the proposed stream crossing replacements, road improvements, road relocation, or repair of existing sediment sources would be completed. These problems would continue to recover or degrade as dictated by natural and preexisting conditions.

3. Effects of Alternative B

This alternative would harvest approximately 523 acres in the South Fork Lost Creek Watershed, with approximately 340 acres harvested with either a helicopter or cable system. Approximately 122 acres of proposed harvest would use low ground pressure tractors, which disturb the ground much less than conventional ground-based equipment. Proposed road construction and reconstruction would be the same as that listed in the FEIS.

4. Effects of Alternative C

This alternative would harvest approximately 607 acres in the South Fork Lost Creek watershed. Approximately 455 acres would be harvested with either a helicopter or cable yarding system. The remainder of the proposed harvest in Alternative C, including road construction, road reconstruction, and other harvest methods would be the same as those described in the FEIS.

5. Effects of Alternative D

This alternative would harvest timber from approximately 514 acres in the South Fork Lost Creek watershed. Roughly 301 acres would be harvested with helicopter or cable yarding systems. The remaining area would be harvested with ground-based machinery, including about 107 acres with low ground pressure tractors. Approximately 1.0 mile of road proposed for construction in the FEIS would not be constructed with this alternative, reducing the total new road construction to 2.4 miles.

6. Effects of Alternative E

This alternative would harvest timber from approximately 254 acres in the South Fork Lost Creek watershed. Roughly 126 acres would be harvested using a cable yarding system, and the remainder would be harvested using ground-based machinery. Of these acres, approximately 20 would use a conventional ground- based yarder, the remaining acres would use a low pressure tractor to remove the timber. Approximately 2.1 miles of new road would be constructed to access the proposed harvest units in this alternative, including 1.7 miles of road, which would permanently replace 1.7 miles of the existing South Fork Lost Creek Road.

B. CUMULATIVE WATERSHED EFFECTS

The potential watershed cumulative effects of the alternatives were determined using the PC version of the R1WATSED model developed by Region 1 of the USFS. All modeling results are estimates based on empirical formulas, and should be used for comparison of alternatives rather than as actual values. WATSED uses the Equivalent Clearcut Area (ECA) method in estimating the increase in water yield caused by removal of live trees. This model also estimates sediment production and delivery resulting from road construction and timber harvest. WATSED is limited in its estimates of sediment routing because it does not account for sediment generated from the bed and banks of a stream adjusting to increases in water yields, or to mitigation measures that limit sediment production.

All the timber-harvest alternatives would implement mitigation measures not included in the WATSED model, resulting in lower sediment production than the model predicts. These activities would include installation of surface drainage on roads, removal of two deteriorating bridges, and replacement of 1.7 miles of the South Fork Lost Creek road where it runs along the creek.

1. Effects of Alternative A

The no-action alternative would generate no cumulative watershed impacts beyond those under current management. ECA levels, water yield increases, and sediment increases would remain at or near present levels and would continue to decline as past harvest units continue to regenerate and move closer to pre-disturbance levels of water use and snowpack distribution.

2. Effects of Alternative B

Approximately 3.0 miles of new road construction (1.3 miles to harvest units and 1.7 to replace the South Fork Lost Creek road) and 523 acres of timber harvest under this alternative would generate approximately 410 ECA and bring the

water yield increase from its current level of 1 percent over baseline to 3 percent over baseline (see table 4-25).

Sediment yield generated by WATSED would be slightly less than those predicted in the FEIS, and would return to pre-harvest levels in approximately 4 years. These levels do not reflect the reduction of sediment from point sources such as those at the bridge rehabilitation sites which would generate a net decrease in sediment over the current condition.

3. Effects of Alternative C

Road construction in this alternative would be the same as that described in the FEIS. Approximately 607 acres of harvest are proposed under this alternative which would generate approximately 487 ECA and bring the water yield increase from its current level of 1 percent over baseline to 3 percent over baseline (see table 4-25).

Sediment yield generated by WATSED would be slightly less than those predicted in the FEIS, and would return to pre-harvest levels in approximately 4 years. These levels do not reflect the reduction of sediment from point sources such as those at the bridge rehabilitation sites, which would generate a net decrease in sediment over the current condition.

4. Effects of Alternative D

Under Alternative D, 0.6 mile of new road would be constructed to access harvest units. This is a reduction of 1.1 miles of road from the original 1.7 miles of new road proposed to access harvest units in the FEIS. This alternative would still construct 1.7 miles of new road to replace 1.7 miles of the existing South Fork Lost Creek where it is located adjacent to the creek. Approximately 514 acres of harvest are proposed under this alternative which would generate approximately 367 ECA and bring the water yield increase from its current level of 1 percent over baseline to 3 percent over baseline (see table 4-25).

Sediment yield generated by WATSED would be slightly less than those predicted in the FEIS, and would return to pre-harvest levels in approximately 6 years. These levels do not reflect the reduction of sediment from point sources such as those at the bridge rehabilitation sites, which would generate a net decrease in sediment over the current condition.

5. Effects of Alternative E

Road construction with alternative E would involve construction of approximately 2.1 miles of new road (1.7 to replace South Fork Lost Creek Road; 0.4 miles to harvest units). All road improvements, and sediment source rehabilitation described for the other action alternatives would also be completed under Alternative E, with the following exception. On the Cliff creek road system, the failing bridge would still be rehabilitated, but improvements to the surface drainage and erosion control would only be completed for approximately 0.8 miles beyond the crossing where grades are steep and erosion is a problem. None of this road system would be used to haul timber under Alternative E. The 254 acres proposed for harvest under Alternative E, combined with the road construction, would generate 125 ECA and would increase the water yield from 1 percent over baseline to 2 percent over baseline.

WATSED indicates Alternative E would generate some potential increase in sediment yield. These potential increases would return to pre-harvest levels in about 3 years. The potential increased sediment yield predicted by WATSED would result primarily from the use of conventional ground-based harvest activities and road construction.

TABLE 4-25. COMPARISON OF WATSED PREDICTED WATERSHED EFFECTS BY ALTERNATIVE FOR SOUTH FORK LOST CREEK.

Watershed Effects	ALTERNATIVES				
	A	B	C	D	E
Acres Harvested	---	523	607	514	254
Miles of New Road	---	3.0	3.6	2.4	2.4
ECA Generated	---	410	487	367	125
Total ECA	319	729	806	686	444
Allowable ECA	3,939	3,939	3,939	3,939	3,939
% Increase Over Baseline Runoff	1%	3%	3%	3%	2%
Allowable Increase Over Baseline Runoff	10%	10%	10%	10%	10%

VII. FISHERIES

Impacts to fisheries of the proposed action alternatives would be similar to those described in the FEIS. The decreased acreage proposed for harvest and reduction of road construction in Alternative D would lessen the potential impacts to fish spawning habitat, and enhance the benefits of the proposed rehabilitation sites. All fish habitat and population monitoring would continue as described in the FEIS.

Sedimentation generated by proposed timber harvest has the potential to adversely affect the quality of bull trout and west slope cutthroat trout habitat. Sedimentation is a fisheries related issue which is discussed in the watershed portion of this document.

A. *EFFECTS OF ALTERNATIVE A*

The fisheries habitat condition would remain essentially unchanged. Erosion sources would not be remedied under the sale proposal. Monitoring of fisheries habitat by DNRC would be discontinued for the South Fork Lost Creek until future projects present the need for additional data.

B. *EFFECTS OF ALTERNATIVES B, C, D AND E*

As agreed to in the immediate actions for bull trout recovery, none of the timber harvest alternatives would harvest in an SMZ containing a bull trout stream. All proposed cutting unit boundaries are well away from SMZ boundaries. All timber harvest alternatives would permanently close 1.7 miles of the existing South Fork Lost Creek road and replace it with a 1.7-mile segment farther up slope, replace the Cliff Creek bridge (except Alternative E), remove and rehabilitate the two bridges over the South Fork Lost Creek which were identified as potential sources of sediment, and install surface drainage features on approximately 10.3 miles of existing road so all roads meet current BMP standards at a minimum. These activities would lead to short term increases in sedimentation during construction. As the sites revegetate and stabilize, there probably would be a long-term benefit to fish habitat by the elimination of long-term and chronic sources of sediment.

All proposed harvest activities present a low risk of impact to fisheries habitat or populations due to implementation of BMP, the SMZ law, Immediate Actions for Bull Trout Restoration, and the Flathead Basin Forest Practices Water Quality and Fisheries Cooperative recommendations.

Fisheries monitoring would continue annually through the duration of the project and for at least 1 year after project completion under any of the timber harvest alternatives.

VIII. AIR QUALITY

After timber harvesting, cutting units are burned to reduce logging residue such as nonmerchantable treetops and limbs. Burning logging residue decreases the risk of wildfire by reducing fuel loading. It also prepares sites for tree regeneration. Burning is usually conducted during the late summer or early fall when weather conditions and fuel moisture levels are optimal to meet burning objectives. During burning periods, smoke would temporarily reduce air quality in the vicinity of the project area.

Light- and moderate-reserve treatments would generate the most residues and the greatest potential affect to air quality.

Structural enhancement treatments would not affect air quality because no burning would be required. For this treatment, logging residue would be hand-lopped and scattered.

A. *EFFECTS OF ALTERNATIVE A*

Alternative A would not affect air quality. No timber harvesting and no burning would occur.

B. *EFFECTS OF ALTERNATIVES B, C, D AND E*

Air quality effects would not exceed the limits defined by the Montana Cooperative Smoke Management Plan (State of Montana Cooperative Smoke Management Plan 1988).

C. *CUMULATIVE EFFECTS*

Air quality cumulative effects would not exceed the limits defined by the Montana Cooperative Smoke Management Plan (State of Montana Cooperative Smoke Management Plan 1988).

IX. VISUAL QUALITY

DNRC used computer-generated images to perform a visual analysis of the project area from various view points. It was determined that the project area could be viewed from the south end of Swan Lake, forest roads within the project area, and the western flank of the Swan valley across from the project area. Each of the timber harvest alternatives would have an effect on the vistas from each of these locations.

A. *EFFECTS OF ALTERNATIVE A*

Alternative A would not affect the visual characteristics of the project area. However, the visual character of the project area would gradually be altered by natural processes and natural disturbances over time.

B. *EFFECTS OF ALTERNATIVE B*

Light-reserve and moderate-reserve harvest would affect the visual quality of the area. Twelve harvest units, ranging from approximately 10 to 55 acres in size, would be scattered throughout the project area. All of these units would be visible from forest roads (10 from open roads and 3 from closed roads) within the sale area. Units adjacent to roads would be screened from view by a visual buffer consisting of a fringe of trees. One unit averaging about 40 acres would be visible from Swan Lake and the western flank of the valley.

One heavy-reserve harvest unit, visible from all three viewing areas, would also affect the visual quality of the area. The heavy-reserve treatment retains approximately 50 percent of the timber after harvest. Visual impacts would be moderated with this treatment This harvest unit would be most noticeable from forest roads within the project area.

C. *EFFECTS OF ALTERNATIVE C*

Light-reserve and moderate-reserve harvest units would affect the visual quality of the area. Sixteen of these harvest units ranging in sizes from approximately 9 to 81 acres would be scattered throughout the project area. All of these units would be visible from forest roads (11 from open roads and 5 from closed roads) within the sale area. Units adjacent to roads would be screened from view with a visual buffer of vegetation. Six units averaging about 14 acres would probably be visible from Swan Lake and the western flank of the valley. These six units, when viewed from a distance, would give the appearance of two openings, one about 11 acres and the other roughly 75 acres.

Two heavy-reserve harvest units would also affect visual quality of the area. These units would be visible only from forest roads (both open and closed) in the project area. Approximately 50 percent of the timber would be left standing within these stands, so visual impacts would mitigated to a degree.

D. *EFFECTS OF ALTERNATIVE D*

Under Alternative D, six light-reserve and moderate-reserve harvest units ranging in size from 11 to 160 acres would be scattered throughout the project area. All of these units would be visible from forest roads (both open and closed) within the sale area. Units adjacent to roads would be screened from view by a buffer of vegetation. One unit about 40 acres in size would be visible from Swan Lake and the western flank of the valley.

Two heavy-reserve harvest units would also affect visual quality of the area. These units would be visible from all three viewing areas, but most noticeable from the forest roads within the proximity of the project area. Approximately 50 percent of the timber would be left standing after harvest and visual impacts would be moderated to a degree.

E. *EFFECTS OF ALTERNATIVE E*

One 11-acre light-reserve harvest unit and one 8-acre moderate-reserve harvest unit located in the northwestern portion of the project area would be visible from forest roads (both open and closed) within the project area.

Two heavy-reserve harvest units would also affect visual quality of the area. These units would be visible from all three viewing areas, but most noticeable from forest roads within the proximity of the project area. Approximately 50 percent of the timber would be left standing after harvest and visual impacts would be moderated to a degree.

X. RECREATION

The South Fork Lost Creek drainage is used for various forms of recreation, including hiking, biking, fishing, camping, hunting, cross country skiing, and wildlife viewing. No detailed recreational use studies have been conducted in or near the project area; however, DNRC is currently working with a graduate student at the University of Montana to conduct such an analysis for state lands. This makes it difficult to determine the number and type of users that recreate in this area and the effect the proposed sale would have on recreation. Due to a general trend of population increase in the Flathead valley and Swan valley and the increasing interest in Northwest Montana by potential visitors, recreational use of the area would probably increase. The improvements that would be made to the South Fork Lost Creek Road, which provides access to Forest Trail 98 into the Bob Marshall Wilderness, also could lead to an increase in recreational use. Timber harvest probably would not eliminate any of the recreation opportunities that currently exist. Some opportunities would be improved, some would decline, and others would remain unchanged.

XI. ECONOMICS

The economic analysis for the South Fork Lost Creek Project estimates the revenue from timber harvesting and the non-administrative costs for the alternatives considered, and displays the current returns from the Northwest Land Office timber program and the total program state wide.

The results of this analysis appear in Tables 4-26 through 4-31.

A. *ASSUMPTIONS*

The following assumption were used to estimate the revenue and non-administrative costs for each alternative:

1. The an initial estimate of harvested volumes for the alternatives were based on the current standing volume (net) from Stand Level Inventory and the following rules:

   Heavy Reserve = 50% Standing Volume
   Moderate Reserve = 80% Standing Volume
   Light Reserve = 90% Standing Volume

   For alternatives D and E a more detailed timber cruise was available. A ratio between the cruised estimate and the initial estimated harvest volume was used to adjust the volume estimated for alternative B and C.

2. The estimated stumpage value was estimated using a residual value approach. The estimated stumpage value equals the delivered log prices minus costs and an amount for profit and risk. Costs include logging costs, haul costs, Forest Improvement fees, development costs, other costs (road maintenance and fish monitoring). The amount for profit and risk was based on 15% of the logging and haul costs. Profit and risk is the return to timber buyer that accounts for actual time and effort, some profit for entrepreneurial spirit, and something to cover the expected losses on an occasional sale that is not profitable.

3. The estimated delivered log price was based on the Montana Sawlog and Veneer Log Price Report (Based on a survey of mills October - December, 1996) from Bureau of Business and Economic Research, The University of Montana. We used the average sawlog prices from Region 2 Western Montana. The species break down by alternative was based on a timber cruise of alternative D and that species-mix was assumed to be the same for Alternatives B and C. Alternative E was based on a subset of the units included in D.

4. Logging costs were estimated from, Costs Associated with Harvest Activities for Major Harvest Systems in Montana (Keegan et al. 1995). The costs were adjusted to current dollars. The logging costs used were; tractor = $101.28 per MBF, FMC = $138.41 per MBF (used forwarder system cost to estimate FMC cost), Cable = $ 168.80 per MBF, and Helicopter = 262.19 per MBF. The average logging cost by alternative was calculated based on a volume-weighted average. Acres by harvesting method were calculated using GIS. The haul costs were estimated by using the following equation: Haul costs = 5.549 + 0.5656 * paved haul distance in miles + 0.982 * unpaved haul distance in miles + 0.4787 * logs per MBF (Mike Niccolucci Personal Communication 1996).

TABLE 4-26. PERCENT OF LOGGING SYSTEM BY ALTERNATIVE

	Alt A	Alt B	Alt C	Alt D	Alt E
Heli	0	21	47	16	0
Cable	0	47	26	43	52
FMC	0	22	14	18	38
Tractor	0	10	12	23	10
Total		100	100	100	100

5. Swan Unit personal estimated development costs for each alternative. Development costs for Alternative B = $315,471, Alternative C = $333,875, Alternative D = $290,000 and Alternative

E= $253,053. Development costs on this proposal are the estimated costs of road, easement acquisition and watershed improvement items that would be paid for by the purchaser. These improvements provide access to the State Trust Lands involved and improve water quality on State Land.

6. Forest Improvement (FI) costs are based on the costs to maintain the ongoing staffing, stand, and road maintenance needs for the current year, right-of-away acquisition and program-wide costs. Funds collected under FI from a purchaser provide the State funding to accomplish projects such as tree planting, site preparation, slash treatment, thinning, road maintenance, right-of-away acquisition, and some timber sale- related activities. Thus, the State is able to improve the long-term productivity of timber stands on State land and maintain or acquire access for future revenue-producing projects.

7. Sale Specific Forest Improvement costs (SSFI) are the current cost estimates for the amounts and types of treatments (site preparation, hazard reduction, planting, etc.) that would be done related to each of the alternatives being considered. Funding to complete these projects will be collected from current or future timber sales depending on the timing of the treatments.

8. The estimated Total dollar return to the Trust is the estimated stumpage value (bid price $/MBF) times the estimated harvest volume.

9. The estimated total dollar amount collected by the State (Total Revenue) is Forest Improvement costs plus the estimated stumpage value times the estimated harvest volume.

10. Another estimated cost associated with this project that will be applied to all action alternatives is for fisheries monitoring, which will be a one-time cost of $20,000.

11. Sale Specific Forest Improvement Costs were estimated based on the following costs: Machine Pile and Scarification = $135.75 per acre (including burning piles), Broadcast burn = $230 per acre (recent contract burning on Plains Unit), Lop and scatter = 12.50 per acre (used in Units with site preparation of None), Full Planting cost = $122 per acre (Seedling cost $0.20 per tree, planting cost of $0.18 per tree for planting 300 trees per acre and $7.25 per acre administration cost), and partial planting cost $47 per acre (Seedling cost $0.20 per tree, planting cost of $0.20 per tree for planting 100 trees per acre and $7.25 per acre administration cost). These costs were estimated based on a discussion with Dan Cassidy. The treatment acres and costs by alternative are depicted in Tables 4-27 and 4-28.

TABLE 4-27. SALE SPECIFIC FOREST IMPROVEMENT ACRES TREATED BY ALTERNATIVE AND METHOD

Alternative	Treatment Method				
	Broadcast Burn	Machine Pile & Burn	Lop & Scatter	Full Planting	Partial Planting
B	365.0	158.0	0.0	44.5	237.7
C	191.0	151.6	264.2	47.0	249.2
D	165.1	349.1	0	221.6	56.3
E	0.0	254.4	0	18.0	0

12. The costs related to the administration of the timber sale program are only tracked at the Land Office and Statewide level. We don't keep track of costs for individual timber sales.

13. Limitations of the economic analysis: (1) Only known costs and benefits that are related to timber harvesting activities are considered; (2) None of the potential non-market benefits associated with leaving trees (i.e. snag recruitment, structural diversity, aesthetics, wildlife habitat, nutrient recycling, etc.) are considered.

14. Alternative A - No Action. We do not have any current money making activities that are solely dependent on this project area.

15. Costs, revenues, and estimates of return are estimates intended for relative comparison of alternatives. They are not intended to be used as absolute estimates of return.

16. DNRC has a sustained-yield volume level of 42,164 MMBF per year Statewide. If timber is not sold and harvested relating to the highest volume alternative in this project, timber would be sold and harvested somewhere else.

TABLE 4-28. SALE SPECIFIC FOREST IMPROVEMENT COSTS BY ALTERNATIVE, METHOD AND TOTAL

Alternative	Costs by Treatment Method and Total					
	Broadcast Burn	Machine Pile & Burn	Lop & Scatter	Full Planting	Partial Planting	Alternative Total
B	$83,950	$20,975	$0	$20,485	$11,231	$136,641
C	$43,930	$20,125	$3,303	$25,600	$11,774	$104,732
D	$37,996	$46,343	$0	$27,037	$2,660	$114,036
E	$0	$33,772	$0	$2,196	$0	$ 35,968

TABLE 4-29. RESIDUAL VALUE APPRAISAL ESTIMATED STUMPAGE VALUE AND ASSUMPTIONS FOR SOUTH LOST PROJECT BY ALTERNATIVE.

RV Appraisal Assumptions (per MBF)	Alt B	Alt C	Alt D.	Alt E.
Delivered Log Prices (assumption 3)	$406	$406	$406	$407
Logging Cost (assumption 4)	($175)	($200)	($163)	($150)
Haul Cost (assumption 4)	($40.86)	($40.86)	($40.86)	($40.86)
Development Costs (assumption 5)	($34)	($31)	($35)	($72)
Forest Improvement Fee (assumption 6)	($46.41)	($46.41)	($46.41)	($46.41)
Other Costs (assumption 10)	($3)	($3)	($4)	($9)
Profit and Risk (assumption 2)	($32)	($36)	($31)	($29)
Estimated Stumpage Value	$74	$49	$86	$60

TABLE 4-30. COSTS AND BENEFITS ASSOCIATED WITH THIS PROJECT BY ALTERNATIVE.

	ALTERNATIVE				
	A	B	C	D	E
1. Estimated Total Harvest Volume (MBF) (Assumption 3)	0.00	9,194	10,900	8,300	3,500
2. Development Costs & Other costs ($/MBF) (Assumption 5 &10)	0.00	$37	$34	$39	$81
3. Estimated Stumpage Value ($/MBF) (Tab. 4-29, last row)	0.00	$74	$49	$86	$60
4. Forest Improvement ($/MBF) (Assumption 6)	0.00	$46.41	$46.41	$46.41	$46.41
5. Estimated Stumpage Value, Forest Improvement and Development Cost ($/MBF) (Line 2 + line 3 + line 4)	0.00	$157.41	$129.41	$171.41	$187.41
6. Total $ Value based on Estimated Stumpage Value, FI cost and Development Cost times estimated harvest volume (line 5 * line 1)	0.00	$1,447,228	$1,410,569	$1,422,703	$655,935
7. Estimated Stumpage Value and Forest Improvement (FI) ($/MBF) (line 3 + line 4)	0.00	$120.41	$95.41	$132.41	$106.41
8. Total $ Revenue to the State (Estimated Stumpage Value + FI cost times estimated harvest volume) (line 7 * line 1)	0.00	$1,107,050	$1,039,969	$1,099,003	$372,435
9. Total $ Return to the Trust (line 1 * line 3)	0.00	$680,356	$534,100	$713,800	$210,000
10. Sale Specific Forest Improvement Costs ($/MBF) (line 11 / line 1)	0.00	$15	$10	$14	$10
11. Total $ Sale Specific Forest Improvement Costs (Table 4-28 alternative total cost column)	0.00	$136,641	$104,732	$114,036	$35,968

B. *COSTS AND REVENUES FROM THE DNRC FOREST SALE PROGRAM*

DNRC does not have an accounting system to track costs for individual projects from start to finish. An annual cash flow analysis was conducted on DNRC's forest product sales program. Revenue and costs are calculated by land office and statewide. The revenue-to-cost ratio is a measure of economical efficiency. A ratio value less than 1.0 means that the costs are higher than the revenues (losing money). A ratio greater than 1.0 means that the revenues are higher than the cost (making money). A ratio equaling 1.0 means that the costs equal the revenues. The revenue-to-cost ratios for the Northwest Land Office for fiscal year 1994 were 3.33, with 2.41 for 1995, 1.51 for 1996, and 1.52 for 1997. Total revenue is revenue from timber sales, permits, Forest Improvement and road maintenance, and total cost is the sum of timber operating and general administration costs. Net Return is total revenue less total cost.

TABLE 4-31. THE NET RETURN/TOTAL REVENUE AND REVENUE/COST RATIOS (TIMBER SALE ACCOUNTING SUMMARY — FY95 & REVISED FY94 MEMO, FY96 , FY97)

	Total Revenue/Total Cost Ratio			
	FY94	FY95	FY96	FY97
Northwest Land Office	3.33	2.41	1.51	1.52
Total Program	2.68	2.07	1.68	1.89

C. *EFFECTS OF ALTERNATIVES A, B, C, D AND E*

The impacts on local communities are estimated by quantifying jobs and income associated with harvesting and processing the timber into final products. Regional response coefficients estimated for northwestern Montana indicate that timber harvesting provides 10.58 direct jobs per MMBF, and a total direct income of $ 337,146 (Keegan et al.) for an average annual income of $ 31,866.35 per job.

It is important to note that the response coefficients are an accounting of what has happened historically. These response coefficients are average values and are not marginal values. To say the consequence of not selling this sale would result in the loss of XX amount of jobs and YYY amount of income may not be correct. A marginal analysis would have to be done in order to be more certain that there would be a reduction in income and employment. Lack of a marginal analysis and the use of average numbers commonly results in over estimation of the total economic effects (Godfrey and Beutler 1993).

XII. IRRETRIEVABLE AND IRREVERSIBLE COMMITMENTS OF NATURAL RESOURCES

A. *IRRETRIEVABLE*

Many stands in the project area are mature with many individual trees more than 200 years old. Any of the timber harvest alternatives would cause some of these large, old, live trees to be irretrievably lost; they would no longer contribute to future snag recruitment, stand structural and compositional diversity, aesthetics, wildlife habitat, nutrient recycling processes or any other important ecosystem functions. Additionally, the roads constructed under all action alternatives would also be considered an irretrievable commitment of resources.

B. *IRREVERSIBLE*

The initial loss of trees due to timber harvesting would not be irreversible. Natural regeneration combined with site preparation and artificial regeneration would promote the establishment of new trees. If management decisions allow for the continued growth of established trees, they would ultimately become equivalent in size and age to the irretrievable, harvested trees.

XIII. RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

All harvest alternatives are designed to protect the long-term productivity of the sites. It is anticipated that the stocking reduction that would occur under each alternative would increase the health and growth of residual stands, resulting in an increase in long-term productivity. The post-harvest stands would more closely resemble stands that existed under average historic conditions, and would provide a variety of opportunities for use in the long term.

XIV. MITIGATION COMMON TO ALL ALTERNATIVES

The following mitigation measures are common to all timber harvesting alternatives. They supplement the mitigation specific to each alternative which are described in Chapter 2. Both specific and common mitigations are based on environmental laws, DNRC policies, DNRC standards and guidelines, consensus of scientific literature, and professional judgement. Implementing of these mitigations is intended to ensure that each alternative complies with pertinent environmental laws, policies, and standards and guidelines.

A. *SOIL AND NOXIOUS WEEDS*

- Comply with BMP for proper drainage on roads.
- Maintain roads and drainage features.
- Schedule management activities to avoid excessive rutting and compaction Clean road construction and skidding equipment of weed seeds, plant parts, and mud before bringing this equipment on site.
- Apply grass seed to exposed soil as soon as possible after disturbance.
- Where possible use existing skid trails and landings to minimize cumulative impacts.
- Where slopes are steeper then 45 percent or where sensitive soils are found, restrict use of conventional ground-based equipment to avoid soil displacement and erosion.
- Weeds would be sprayed with herbicides using spot applications when necessary (Categorical Exclusion 1997, in project file).

To further limit the possible spread of weeds the following integrated weed management mitigation measures of prevention and control will be implemented:

(1) Clean road construction and skidding equipment of weed plant parts and mud prior to bringing on site.

(2) Revegetate disturbed roadsides and landings with site adapted grasses. For grass seeding to be effective it is important to complete seeding concurrent with road construction.

(3) Contractor would be required to control weeds along access roads by herbicide methods as designated by the forest officer in charge.

Herbicide Application

To reduce risk to aquatic and terrestrial resources the following will be required:

(1) All herbicides would be applied by licensed applicators in accordance with laws, rules and regulation of the State of Montana and the Lake County Weed District.

(2) All applications would adhere to Montana BMPs and the herbicide's specific label guidelines.

(3) Herbicide application would not be general but site specific to areas along roads where noxious weeds are occurring. All no-spray areas will be designated on the ground before application begins.

(4) Herbicide would not be sprayed along the county road R/W in section 32 or near Boles Creek. Picloram would not be applied within fifty feet of surface water. 2,4-D could be applied to within twenty five feet of surface water. No herbicides would be applied within twenty five feet of surface water.

(5) Herbicides would not be applied to areas where relief may contribute runoff directly into surface water.

(6) Application would occur on calm, dry days to limit drift and possible surface movement off road prisms.

B. *ROADS*

- Road reconstruction and maintenance work would be performed along Forest Service roads #680 and #9521. Approximately 1.7 miles of road would be built to replace a portion of Road #680 that is close to the creek and in danger of being eroded.

- Potential sediment source sites (see Chapter 3 and 4, Watershed) would be mitigated and corrective actions, such as installation of drainage features and removal of two bridges, would take place as part of this project. Control of noxious weeds also would be treated as part of all road projects.

C. *WILDLIFE*

1. Grizzly bear

- All timber harvest alternatives meet the intent of the Swan Valley Grizzly Bear Conservation Agreement (see Grizzly Bear effects assessment in this chapter for more information).
- No more than 33 percent of any grizzly bear subunit shall exceed 1 mile per square mile of open road density, to lessen vulnerability to human-caused mortality and displacement.
- Timing and duration of harvest activities would be scheduled to limit displacement from core areas, linkage zones, and other areas of suitable habitat.
- A visual screening buffer would be left along open roads and along restricted roads that are located along the outside edge of even-aged harvest units. Exceptions might be required where cable logging systems are used.
- Cover "vegetation blocks" would be retained within large even-aged harvest units to ensure that no point in the unit is more than 600 feet from cover.
- Hiding cover would be retained on at least 40 percent of the grizzly subunit.

2. Gray Wolves

1) Contact the USFWS 1-2 weeks prior to any mechanized sale work to determine the possible presence of wolves in the area.

2) suspension of operations and temporary restriction of use of roads within a 1 mile radius of any known active wolf den until the wolves have vacated the site, a DNRC Biologist has approved re-commencing project activity, or July 15, whichever occurs earlier.

3) suspend operations and consult a DNRC Biologist if a suspected rendezvous site is observed within 0.5 miles of any ongoing project activities.

4) retain connective corridors of heavy forest cover when possible to maintain travel routes, visual screening and security for elk and deer.

5) minimize construction of additional roads (open and closed) in this area, and close, slash, and/or barricade as much new road as possible (within forested vegetation types) to reduce increased potential for foot and unauthorized motor vehicle traffic.

3. Bald Eagle

1) Cease all operations and develop a travel plan consistent with DNRC sensitive species guidance for bald eagles if a nesting pair is observed within one mile of any project-related activities.

4. Sensitive Species

a) Black-Backed Woodpecker

1) As treatments attempt to emulate natural disturbance events, any trees killed by prescribed fire activities would not be salvaged.

b) Boreal Owl

1) Maintain and recruit snags in the largest diameter classes available on northerly exposures >5,200 ft. in elevation (particularly western larch, ponderosa pine, and Douglas-fir)

2) Retain patches of dense, old spruce/fir stands (>20 acres) where possible that have mature and over mature western larch well-represented in them.

c) Fisher

1) Retain minimum 82 ft. (ephemeral) and 165 ft. (perennial) unharvested buffers along each side of riparian areas found within the project area.

2) Retain all cull trees > 21" as snag recruits.

3) Maintain interconnected patches of well-stocked (>40% canopy) mature and over-mature saw timber throughout draw bottoms and across ridges and saddles to facilitate potential movements of fisher.

4) Keep new road construction to a minimum and obstruct all roads feasible within forested stands with heavy amounts of slash and/or barriers, to minimize additional motor vehicle and foot access.

d) Lynx

1) Maintain interconnected patches of well-stocked (>40% canopy) mature and over-mature saw timber with patchy understories throughout draw bottoms and across ridges and saddles to facilitate potential movements of lynx.

2) Keep new road construction to a minimum and obstruct all roads feasible within forested stands with heavy amounts of slash and/or barriers, to minimize additional motor vehicle and foot access.

e) Pileated Woodpeckers

1) Maintain representative amounts of western larch, ponderosa pine and Douglas-fir snags and snag recruits in the largest diameter classes available.

2) Retain all snags of all diameter classes that do not pose unacceptable risks to human safety.

3) Retain adequate amounts of coarse woody debris on site following treatments.

4) Retain integrity of clumped mature and overmature western larch, ponderosa pine, and Douglas-fir patches whenever possible.

5. Coarse Filter - Other Species

1) Retain all snags where possible to retain roosting opportunities for cavity-nesting species. Minimum snag and snag recruitment reserves would meet or exceed DNRC's SFLMP Guidance for Biodiversity.

2) Timber harvesting activities would be restricted until after July 15 to protect nesting birds. Road reconstruction and construction, slash disposal and scarification would be permitted before July 15.

6. Big Game

1) Regenerate harvest units as soon as possible following treatment.

2) Gate, slash and/or obliterate as much of the new road system as possible to lessen the risk of increased foot travel.

3) Retain connectivity across ridges and saddles, and retain the largest, closed-canopy patches possible.

4) Retain existing regeneration pockets for visual screening.

D. WATERSHED AND FISHERIES

- Meet Best Management Practices and Streamside Management Zone rules.
- Improve surface drainage system, if necessary, on existing roads.
- Schedule timing and duration of harvest activities to reduce potential soil displacement and sediment delivery to streams.

E. AIR QUALITY

- Follow smoke management guidelines that are regulated by the Montana Cooperative Airshed Program.

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GLOSSARY

Acre-foot
A measure of water or sediment volume, equal to an amount of material that would cover one acre to a depth of one foot.

Aesthetic
Pertaining to beauty.

Airshed
An area defined by a certain set of air conditions; typically a mountain valley in which air movement is constrained by natural conditions such as topography.

Appropriate Conditions
Describes the set of forest conditions determined by DNRC to best meet SFLMP objectives. The four main components useful for describing an appropriate mix of conditions are cover type proportions, age class-distribution, stand structural characteristics and the spatial relationships of stands (size, shape, location, etc.) all assessed across the landscape.

B-4 Channel Type
The South Fork of Lost Creek is classified as a B-4 channel type according to the stream classification system developed by David Rosgen (1994). B-4 channel types include channel gradients of 2-4 percent, width to depth ratio greater than 12, and channel materials composed mainly of coarse gravel. B-4 channels are considered moderately stable, and have a very high recovery potential. This means that bed and banks are moderately prone to becoming unstable given a disturbance (e.g. water yield increases, physical disturbance), but that they also reach a stable equilibrium rapidly or respond well to rehabilitation. They tend to have low natural rates of bank erosion, but do carry high levels of bedload (larger creek bed material which is not suspended in the water, but rolls downstream along the channel bottom).

Basal Area
A measure of the number of square feet of space occupied by the stem of a tree.

Best Management Practices
A practice or combination of practices that is determined by a state or designated area-wide planning agency to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.

Bioaccumulate
The process of a plant or animal selectively taking in or storing a persistent substance. Over time, a higher concentration of the substance is found in the organism than in the organism=s environment.

Biocontrol Agents
Noxious weed control without the use of chemicals, machines, fire or hand tools. Parasites, grazing, predators, diseases, etc. are used to control.

Biodiversity
The variety of life, and its processes. It includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

Board Foot
144 cubic inches of wood, equivalent to piece of lumber 1-inch thick by 1-foot wide by 1-foot long.

Boreal Forest
The type of forest found in the Northern Temperate Zones and Arctic region.

Canopy
The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

Cavity
A hollow excavated in trees by birds or other animals. Cavities are used for roosting and reproduction by many birds and mammals.

Characteristic Landscape
The overall impression of a landscape created by its unique combination of visual features (such as land, vegetation, water, and structures) as seen in terms of form, line, color, and texture.

Compaction
Increase in soil density caused by force exerted at the soil surface.

Connectivity
The quality, extent, or state of being joined; unity; the opposite of fragmentation.

Contrast
A term used in visual assessments to indicated the degree to which objects are distinguishable from one another.

Core Area
See Security Habitat (grizzly bears)

Corridor
- *Mature forest corridor* - A contiguous area of mature forest at least 100 meters wide, having at least 40 percent canopy cover, and connecting two or more larger areas of mature forest.
- *Movement corridor* - A narrow but continuous area of habitat connecting larger areas of habitat that animals use for travel. Often referred to as dispersal or wildlife corridor.

Cover
See HIDING COVER and/or THERMAL COVER.

Crown Classes:
- *Codominant Crown Class*—Trees with crowns forming the general level of the crown cover and receiving full light from above but comparatively little from the side; usually with medium-sized crowns more or less crowded on the sides.

- *Dominant Crown Class*—Trees larger than the average in stands, with well-developed crowns extending above the general level of the crown cover and receiving full light from above and partly from the side, possibly somewhat crowded on the sides.

- *Intermediate Crown Class*—Trees with crowns extending into the crown cover formed by codominant and dominant trees; receiving a little direct light from above but none from the sides; usually with small crowns considerably crowded on the sides.

Cumulative Impacts or Effects
The collective impacts on the human environment of the proposed action when considered in conjunction with other past and present actions related to the proposed action by location or generic type. Related future actions must also be considered when these actions are under concurrent consideration by any state agency through pre-impact statement studies, separate impact statement evaluation, or permit processing procedures (ARM 36.2.522(7)).

Cutting Units
Areas of timber proposed for harvest.

DBH (diameter at breast height) Class
A group of trees within a given diameter range, e.g., 5 to 10 inches

Discounting
In economics, a method of accounting for the value of money over time, its ability to earn interest, so that costs and benefits occurring at different points in time are brought to a common date for comparison.

Ditch Relief
A method of draining water from roads using ditches and a corrugated metal pipe. The pipe is placed just under the road surface.

Dominance Elements (in a landscape)
Landscapes are dominated by the primary elements of color, texture, form, and line. When changes occur within that landscape, changes also may occur to these elements. The elements are:
- *Color* - Color (or degree of a certain color) on the landscape.
- *Texture* - The surface characteristics, or coarseness, of objects within the landscape or overall patterns of surface characteristics on the landscape.
- *Form* - The overall shape and structure of an object such as a tree or mountain.

- *Line* - The direction of a major pattern within the landscape such as tree trunks in a forest.

Drainage Area
See WATERSHED.

Ecosystem
An interacting system of living organisms and the land and water that make up their environment; the home place of all living things, including humans.

Environmental Effects
The impacts or effects of a project on the natural and human environment.

Equivalent Clearcut Area (ECA)
The total area within a watershed where timber has been_harvested, including clearcuts, partial cuts, roads, and burns.

- *Allowable ECA* - The estimated number of acres that can be clearcut before stream channel stability is affected.
- *Existing ECA* - The number of acres that have been previously harvested taking into account the degree of hydrologic recovery that has occurred due to revegetation.
- *Remaining ECA* -The calculated amount of harvest that may occur without substantially increasing the risk of causing detrimental effects to stream channel stability.

Excavator Piling
Piling of logging residue using an excavator.

Fall-transition Range
Forage areas used by deer as they move from the higher elevations they occupy in the summer to the lower elevations they occupy in the winter.

Fire Regimes
Describes the frequency, type and severity of wildfires. Examples include: frequent, non-lethal underburns; mixed severity fires; and stand replacement or lethal burns.

Flush
A brief abundance (as in the flush of insects after a wildfire).

Forage
All browse and non-woody plants available to wildlife for grazing.

Forest Improvement
The establishment and growing of trees after a site has been harvested. Associated activities include site preparation, planting, survival checks, regeneration surveys, and thinning of the stand.

Forest Products
Products derived from trees, such as lumber, poles, and fuel chips.

Fragmentation (forest)
A reduction of connectivity and increase in sharp stand edges resulting when large contiguous areas of forest with similar age and structural character are interrupted through disturbance (e.g., stand replacement fire, timber harvesting).

Grass/Shrub/Seedling Size Class
A ground cover predominantly of grass, shrub or seedlings (live trees less than 1.0 inch dbh)

Habitat
The place where a plant or animal naturally or normally lives and grows.

Habitat Effectiveness
The percentage of available habitat that is useable by elk during the non-hunting season (in comparison to potential elk use).

Habitat Type
An aggregation of all land area potentially capable of producing similar plant communities at climax.

Hand-burning
The process of manually igniting piles of logging residue.

Hazard Reduction
The abatement of a fire hazard by processing logging residue with methods such as separation, removal, scattering, lopping, crushing, piling and burning, broadcast burning, burying, and chipping.

Hectare
Ten thousand square meters or 2.47 acres.

Hiding Cover
Applicable to Grizzly Bears, elk, white-tailed deer and mule deer - A patch of vegetation having a minimum width of at least three sight distances (distance at which 90 percent of a bear-sized animal is hidden from view) or 300 feet—whichever is greater.

Historical Forest Condition
The condition of the forest prior to settlement by Europeans.

Interdisciplinary Team
A team of resource specialists brought together to analyze the effects of a project on the environment.

Irretrievable Commitment of Resources
Resources that are lost for a period of time, such as harvested timber or other renewable natural resources. A stand of trees that is cut has been irretrievably lost (as opposed to irreversibly lost) because the stand can regenerate.

Irreversible Commitment of Resources
Loss of resources that cannot be reversed except perhaps in the extreme long term, such as minerals, historical or archaeological resources; or vegetation and habitat lost to permanent roads. Irreversible also refers to the loss of future options.

Linkage Zones
Areas delineated in Attachment E of the SVGBCA for the purpose of enhancing grizzly bear habitat connectivity between the Swan and Mission mountains.

Logging Residue
Unmerchantable logs, uprooted stumps, broken or uprooted stems, branches, twigs, leaves, bark, and chips left on the ground after timber harvesting, storms, fire, or other disturbance.

Lop and Scatter
Bucking up and scattering logging residue to reduce fire hazard.

Low-elevation Linkage Zones
Lower elevation portions of Linkage Zones delineated in Attachment H of the SVGBCA.

Mass Failure
A downhill movement of soil or fractured rock under the force of gravity, e.g., a landslide..

Mature Forest Types
Forested stands categorized as old growth or saw-timber.

McNeil Coring
A method of measuring a sample of stream bed material to determine the percentage of fine material. The higher the percentage of fine material within the stream bed the lower the quality of spawning habitat for trout.

Merchantable
Describes trees that can be profitably converted into a salable product such as lumber.

Mitigation Measure
Measure designed to reduce or prevent detrimental effects.

Moving Window
A computer-based method used to quantify the area influenced by roads in a study area. Starting with the pixel in the upper left corner of the computerized subunit map, the computer calculates how many miles of road exist within a 1 square mile "window" around that pixel. It moves to the next pixel and repeats the process until the road density is calculated in a 1 square mile area around every pixel in the study area. The number and percentage of pixels in the study area that fall into different road density classes are then calculated by the computer. Based on research studying the effects of roads on grizzly bears, the effects of open roads are measured by the percentage of the pixels in the study area which have at least 1.0 miles of open road in the surrounding 1 square mile window. The effects of total roads (open, gated, barricaded, bermed but not brushed, etc.) are measured by the percentage of pixels in the study area which have at least 2 miles of open or restricted roads in the surrounding 1 square mile window.

Multi-story Stands
Timber stands with two or more distinct stories.

No-action Alternative
The option of maintaining the status quo and continuing present management activities and/or not implementing the proposed project.

NOEL
The no-observable-effect level. In a series of dose levels tested, it is the highest level at which no effect is observed in the species tested.

Non-forested Area
A naturally occurring area where trees do not establish over the long-term such as a bog or avalanche chute.

Old Growth
Stands that are 150 years and older (140 years for lodgepole pine) that exhibit a range of structural attributes associated with old age, and that contain a minimum of 4 MBF per acre net.

Old Stands
Term used by Losensky (1997) to describe stands from the 1930s inventory. Stands were considered old if they were over 170 years for ponderosa pine, Douglas-fir, and western larch/Douglas-fir; 180 years for white pine, subalpine and mixed conifer; and 140 years for lodgepole pine.

Older Pole
Pole-timber stands more than 40 years old.

Overstory
SRSF Stand Level Inventory code applies this term to any stand that contains commercial-size trees in excess of 1,000 board feet per acre, and which also meets one of the following conditions (1) The trees in question are relics (i.e. not part of the manageable stand components); (2) The trees in question represent the upper story of a two-story stand, but they are inadequately stocked to be treated as a separate management component.

Patch
A discrete area of forest connected to other discrete forest areas by relatively narrow corridors; an ecosystem element (such as vegetation) that is relatively homogeneous internally but differs from what surrounds it.

Patch Shape Index
A system for assessing patch shape, or a number indicating this shape. The system used in this EIS was developed by McGarigal and Marks (1994). Under this system, a perfectly square patch is represented by the number 1. Circular patches are indicated with numbers less than one. The higher the number, the more complex the shape.

Pole Timber

- *Pole-timber stands* - Stands at least 16.7 percent stocked with growing stock trees of which 50 percent or more are in pole timber and/or saw-timber trees, and with pole-timber stocking exceeding that of saw timber.
- *Pole-timber trees* - Trees at least 5.0 inches dbh but smaller than 9.0 inches for softwoods and 11.0 inches for hardwoods.

Preferred Habitats
Areas adjacent to streams and wetlands inside Linkage Zones as set forth in Attachment G of the SVGBCA.

Project File
A public record of the analysis process, including all documents that form the basis for the project analysis. The project file for the South Lost Creek EIS is located at the Swan River State Forest office near Swan Lake, Montana.

Reach
A portion of a body of flowing water.

Redds
The spawning nests of trout.

Regeneration
Trees in the seedling and sapling stage of growth; or the act of establishing young trees naturally or artificially.

Regeneration Harvest
A type of harvest conducted with the twin purposes of removing old trees and creating environments favorable for establishment of new trees.

Risk

- *High risk* - An SRSF Stand Level Inventory code which pertains to the following: (1) All commercial, nonvigorous, overmature stands, and any merchantable stand that exhibits an unmanageable insect or disease problem; or (2) Lodgepole saw-timber stands over 100 years old.

- *Low risk* - An SRSF Stand Level Inventory code that pertains to the following types of stands (1) All commercial stands older than 100 years that do not qualify as high risk (They have relatively better vigor than high-risk stands); (2) All commercial stands that do not qualify as high risk and are dominated by shade-tolerant species (regardless of age); (3) All commercial lodgepole stands 50-100 years old and nonvigorous, and which have not qualified as high risk; (4) Various other stands containing commercial material which are not manageable because of poor tree quality and vigor.

Road Improvements

Construction projects on an existing road to improve ease of travel, safety, drainage, and water quality.

Roads

The following kinds of roads were considered in road density estimates for grizzly bear habitat.

- *Administrative roads* - Administrative roads provide access to administrative structures or to noncorporate private property. Administrative roads are excluded from calculations of open road density and total road density.

- *Open roads* - Open roads pertaining to the grizzly bear analysis are roads without use restrictions. They are seasonally opened to the public during the non-denning period (3/16 - 11/15). They are administered by DNRC, Plum Creek, or the U.S. Forest Service (USFS).

- *Private roads* - Roads on nonindustrial private lands. Private roads are excluded from open and total road density estimates.

- *Reclaimed roads* - Reclaimed roads are generally impassable to motorized vehicles for most of their length. Drainage features on the road are not maintained because future use of the roads is not intended. Reclaimed roads are not included in linear mileage or road density calculations.

- *Restricted roads* - A road administered by DNRC, USFS, or Plum Creek on which motorized use is restricted during the entire nondenning period (3/16-11/15) by a physical obstruction. Restricted roads are included in calculations of total road density.

- *Total road density* - Using the moving windows method, total road density is expressed as the percentage of an area with a total road density of at least 2.0 miles per square mile. Roads used for calculating total road density include open roads, easement roads, and roads closed by a closure (e.g., gated) excluding berms.

Roll Dip

A graded depression built into a road to divert water and prevent soil erosion.

Rotation Schedule

The schedule (in years) set forth in Attachment I of the SVGBCA, by which the parties to the SVGBCA concentrate Administrative and Commercial Use within grizzly bear management subunits in the Swan Valley Conservation Area.

Saplings

Trees 1.0 inches to 4.0 inches in diameter at breast height.

Saw-timber Trees

Softwood trees 9.0 inches and larger dbh.

Scarification

The mechanized gouging and ripping of surface vegetation and litter to expose mineral soil and enhance the establishment of natural regeneration.

Scope
The range of reasonable alternatives, mitigation, issues, and potential impacts to be considered in an environmental assessment or environmental impact statement.

Scoping
The process of determining the extent of the environmental assessment task. Scoping includes public involvement to learn which issues and concerns should be addressed, and the depth of assessment that will be required. It also includes a review of other factors such as laws, policies, actions by other landowners, and jurisdictions of other agencies that may affect the extent of assessment needed.

Security
For wild animals the freedom from the likelihood of displacement or mortality due to human disturbance or confrontation.

Security Area (elk)
An area of at least 250 contiguous acres that is more than 0.5 miles from all roads with use levels of more than one vehicle per week.

Security Habitat (grizzly bears)
An area of at least 2,500 acres that is at least 0.3 miles from trails or roads with motorized travel and high-intensity, nonmotorized use during the nondenning period.

Seedlings
Live trees less than 1.0 inch dbh.

Sediment
In bodies of water, solid material, mineral or organic, that is suspended and transported or deposited.

Sediment Yield
The amount of sediment that is carried to streams.

Sequoia Index
A number indicating increased sedimentation caused by forest management activities, and the method used in determining this.

Seral
Refers to a biotic community that is in a developmental, transitional stage in ecological succession.

Shade-intolerant

Describes tree species that generally can only reproduce and grow in the open or where the overstory is broken and allows sufficient sunlight to penetrate. Often these are seral species that get replaced by more shade-tolerant species during succession. In the Swan valley, shade-intolerant species generally include ponderosa pine, western larch, Douglas-fir, white pine, and lodgepole pine.

Shade-tolerant
Describes tree species that can reproduce and grow under the canopy in poor sunlight conditions. These species replace less shade-tolerant species during succession. In the Swan valley, shade-tolerant species generally include subalpine fir, grand fir, Douglas-fir, Engelmann spruce, and western red cedar.

Sight Distance
In the case of grizzly bears, refers to the distance at which 90 percent of a bear is hidden from view.

Silviculture
The art and science of controlling the establishment, composition, and growth of forests, to accomplish specific objectives.

Site Preparation
A hand or mechanized manipulation of a harvested site to enhance the success of regeneration. Treatments are intended to modify the soil, litter, and vegetation and to create microclimate conditions conducive to the establishment and growth of desired species.

Snag
A standing dead tree.

Snow Intercept
The action of trees and other plants in catching falling snow and preventing it from reaching the ground.

Spur Roads
Temporary roads, closed after harvest, constructed to meet minimum requirements for harvest-related traffic.

Stand
An aggregation of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition as to be distinguishable from the adjoining forest.

Stand Density
Number of trees per acre.

Stocking
The degree of occupancy of land by trees as measured by basal area or number of trees and as compared to a stocking standard, which is an estimate of either the basal area or number of trees per acre required to fully use the growth potential of the land.

Stream Gradient
The slope of a stream along its course, usually expressed in percentage indicating the amount of drop per 100 feet.

Stumpage
The value of standing timber; the market value of manufactured forest products or sawlogs minus their production costs.

Subnivean Spaces
Air pockets or open areas beneath the surface of the snow.

Substrate Scoring
Rating of a streambed particle sizes.

Succession
In plant communities, the process of progressive changes with growth.

Swan Valley Conservation Area
Geographic area encompassed by the Swan Valley Grizzly Bear Conservation Agreement

Texture
A term used in visual assessments indicating distinctive or identifying features of the landscape depending on distance.

Thermal Cover (elk)
A stand of conifers at least 40 feet tall with an average canopy closure exceeding 70 percent.

Timber Harvesting Activities
In general, Atimber harvesting activities@ refers to all the activities conducted to facilitate timber removal before, during, and after the timber is removed. These activities may include any or all of the following:

- felling standing trees and bucking into logs
- skidding logs to a landing
- processing, sorting, and loading logs at the landing
- hauling logs to a mill
- road construction
- right-of-way clearing
- excavation of cut/fill material
- installation of road surface and ditch drainage features
- installation of culverts at stream crossings
- burning right-of-way slash
- hauling and installation of borrow material
- blading and shaping road surfaces
- slashing and sanitizing residual vegetation damaged during logging
- machine piling logging slash
- burning logging slash
- scarification
- planting trees

Total Road Density

See ROADS

Understory
The trees and other woody species growing under a more-or-less continuous cover of branches and foliage formed collectively by the overstory of adjacent trees and other woody growth.

Variety
A term used in visual assessments indicating landscapes that are object-rich.

Vigor
The degree of health and growth of a tree or stand.

Vigor Class
The following vigor classes are based on the SRSF Stand Level Inventory.

- *full vigor* - The full vigor class is represented by open-grown trees. Crown closure has not occurred, and growth is optimal.
- *good-to-fair vigor* - Crowns are closed at least in clumps; crown lengths are greater than 50 percent in young stands and greater than 33 percent in older stands. Growth has not yet slowed greatly.
- *fair-to-poor vigor* - Crown ratios are poor. Growth and mortality are nearly balanced.
- *very poor vigor* - Stands having very poor vigor are generally in a decadent condition due to insects, disease, stagnation, suppression or old age. Mortality is likely to exceed growth.

Visual Screening
Vegetative cover which, at the minimum, hides 90 percent of a grizzly bear.

WATSED
A computer model that uses existing condition data to predict increases in water yield over natural conditions and related increases in sediment entering streams.

Watershed
The region or area drained by a river or other body of water.

Water Yield
The average annual runoff for a particular watershed expressed in acre-feet.

Water Yield Increase
An increase in average annual runoff over natural conditions due to forest canopy removal.

Weibull Function
An equation useful for determining age class distributions. The equation is: $P=1-\exp(-age/a)^b$ where P=proportion of acres in an age class; a=fire return interval in years; and ^{b}=shape parameter (Johnson and VanWagner 1985).

Yield Capability
The maximum mean annual increment of wood that can be grown in a fully stocked natural stand expressed in cubic feet per acre per year.

Young Pole
Pole-timber stands that are less than 30 years old.

APPENDIX A

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Pathfinder, Box 702, Seeley Lake 59868 677-2022 (December 8th)

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APPENDIX C

Old Growth Attribute Assignments Protocols and Effects on Old Growth

SNAGS

Lots = [6 trees at 21"or greater dbh] OR [11 trees at 15" or greater dbh] possible combinations (listing 21"+ category first, and 15"+ category second) are (6,0), (6,1), (6,6), (6,11), (11,0), (11,1), (11,6), (11,11), OR (0,11), (1,11)

Some = [1 tree at 21"+] OR [6 trees at 15"] possible combinations (listing 21"+ category first, and 15"+ category second) are (1,0), (1,1), (1,6) OR (0,6)

Few = [1 tree at 15"] possible combinations (listing 21"+ category first, and 15"+ category second) are (0,1)

None = [0 trees at 21"+ AND 0 trees at 15"] possible combinations (listing 21"+ category first, and 15"+ category second) are (0,0)

LARGE COARSE WOODY DEBRIS

DWOODSM = # small pieces (< 16")of CWD within a 300-foot transect
DWOODLG = # large pieces (> 16") of CWD within a 300-foot transect

CWDNEW = DWOODSM + (3*DWOODLG)

Lots = CWDNEW >= 27

Some = CWDNEW >= 14 and <27

Few = CWDNEW >= 3 and <14

None = CWDNEW 0, 1, or 2

LARGE LIVE TREES

Listing the # of trees in the 21" or greater dbh category first, and 17" or greater dbh category second; all possible combinations are shown for each class.

Lots = (11, 11)

Some = (6, 11); (6, 6); (1, 11)

Few = (1, 6); (1, 1); (0, 11); (0, 6)

None = (0, 0); (0, 1)

SOUTH LOST HARVEST EFFECTS ON OLD GROWTH ATTRIBUTES

TREATMENT (current condition)	LARGE TREES	SNAGS	CWD	DECADENCE
LIGHT RESERVE				
NONE	NONE	NONE	FEW	NONE
FEW	FEW	FEW	FEW	NONE
SOME	FEW	SOME	SOME	NONE
LOTS	FEW	SOME	SOME	NONE
MODERATE				
NONE	NONE	NONE	FEW	NONE
FEW	FEW	FEW	FEW	NONE
SOME	SOME	SOME	SOME	NONE
LOTS	SOME	SOME	SOME	NONE
HEAVY RESERVE				
NONE	NONE	NONE	FEW	NONE
FEW	FEW	FEW	SOME	NONE
SOME	SOME	SOME	SOME	FEW
LOTS	SOME	SOME	SOME	SOME

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